NEW ZEALAND GEOGRAPHER

5 No. 1
L, 1949

N.Z. GEOGRAPHICAL SOCIETY (INC.)

THE NEW ZEALAND GEOGRAPHICAL SOCIETY

Addresses for Correspondence

Contributions for publication in the *New Zealand Geographer*, books and articles for review, and all correspondence on editorial matters should be addressed to:

The Editor,
New Zealand Geographer,
Department of Geography,
Auckland University College,
Auckland, C.1, New Zealand.

All business correspondence, including subscriptions from overseas members and intending members, and libraries and institutions in New Zealand and abroad, should be addressed to:

The Secretary,
New Zealand Geographical Society,
Department of Geography,
University of Otago,
Dunedin, N.1, New Zealand.

All cheques etc. should be made payable to the New Zealand Geographical Society (Inc.) and crossed.

Members and intending members in New Zealand should address their correspondence to their local branch secretary, as follows:—

Auckland Branch:
Mr. R. G. Lister,
Department of Geography,
Auckland University College,
Auckland, C.1.

Wellington Branch:
Miss J. K. Finney,
Flat 4, 178 The Terrace,
Wellington, C.1.

Canterbury Branch:
Mr. A. V. Barley,
9 Ngahere Street,
Riccarton, Christchurch, W.1.

Otago Branch:
Mr. W. F. Reid,
15 Wallace Street,
Roslyn, Dunedin, N.W.1.

THE NEW ZEALAND GEOGRAPHER

CONTENTS OF VOLUME V, NUMBER 1, APRIL, 1949

PAGE

ew Zealand's 'Pacific Island Neighbourhood': The Postwar Agricultural Prospect . . . . . . *By Kenneth B. Cumberland* 1

he Galatea Basin: A Geographic Reconnaissance *By James W. Fox and R. G. Lister* 19

he Coromandel Peninsula and the Thames Valley . *By Murray McCaskill* 47

he Origin of Schist Tors in Central Otago . . *By J. D. Raeside* 72

he Form and Functions of North Canterbury Townships: Photogeography *Photographs selected by J. S. Duncan* 77

ew Zealand Geographical Society: Branch Affairs 86

eographic Notebook 88

Our Contemporaries 95

eviews 97

The Society is not responsible for the opinions or statements of writers in this Journal.

Published half-yearly at the press of
WHITCOMBE AND TOMBS LTD., CHRISTCHURCH, NEW ZEALAND
by the New Zealand Geographical Society (Incorporated)

EDITORIAL OFFICE: Auckland University College, Auckland, New Zealand

EMBERSHIP OF THE SOCIETY is to be obtained through the constituent Branches: nual dues *one pound* (Members are entitled to receive one copy of all the Society's publications.)

BSCRIPTIONS TO THE JOURNAL are accepted from libraries and other organisations New Zealand at the annual rate of *one pound*, and from both libraries and individuals overseas he rate of *one pound* in the currency of the country to which the journal is to be addressed. *ur dollars* in the United States and Canada.)

GEOGRAPHIC NOTEBOOK

PAGE
Contributors to this Issue 88
Seventh Pacific Science Congress 88
Social Studies 91
The Society's Library 92
World Food Supplies: Fats and Oils 93

IN OUR CONTEMPORARIES

1. *In New Zealand Journals . . .*

Agriculture in Northern New Zealand . . . *By L. W. McCaskill* 95

2. *In Overseas Journals . . .*

Some Observations on Continental Drift 96

REVIEWS

H. F. von Haast. The Life and Times of Sir Julius von Haast *By G. Jobberns* 97
G. G. M. Mitchell. Maori Place Names in Buller County *By Roger Duff* 98
L. I. Grange and H. S. Gibbs. Soil Erosion in New Zealand. Part 1: Southern Half North Island . . . . *By L. W. McCaskill* 98
Ed. Alan Mulgan. The Maori in Picture . . . 99
A Pakeha Maori (F. E. Maning). Old New Zealand . 100
Fergus B. McLaren. The Auckland Islands . . . *By J. C. Reid* 100
Army Education Current Affairs Staff. Our Own Country *By L. L. Pownall* 101
G. M. Roseveare. The Grasslands of Latin America . . *By P. D. Sears* 102

New Zealand Geographer

VOLUME V April, 1949 NUMBER 1

NEW ZEALAND'S 'PACIFIC ISLAND NEIGHBOURHOOD': THE POSTWAR AGRICULTURAL PROSPECT*

KENNETH B. CUMBERLAND

WORLD WAR II engulfed the island territories of the southwest Pacific: it made many of their native inhabitants participants in the conflict and brought to practically all the others ideas and experiences completely alien to their former way of life. This wholesale disturbance has fortunately been recorded by geographers. Coulter[1] has described the transformation in the landscape brought about by the erection of piers, breakwaters and moles, and by the construction of expansive airstrips, aircraft shelters, barracks, hospitals and supply depots. He has also explained the disruption of indigenous social and economic life by the influx of foreign troops, the recruitment of native combatants and labourers, the cutting off of copra exports, the increase in the number of interracial marriages, the disruption of traditional institutions and habits and the establishment of a 'dollar economy'. Others have described the physical devastation of war. Bowman[2] and Coulter[3] have recorded the gearing of native agriculture to the production of both native and alien vegetables for the supply of the armed forces stationed in the islands.

After little more than four years of peace the surprising thing throughout those islands between the Kermadecs and the Tokelaus and between Mangaia and the Yasawas—an expansive ocean area in which New Zealand has particular interest—is the extent to which the remnants of war, and of war's disturbances, have disappeared. Military buildings have been taken down or used for peacetime administrative purposes as offices, hospitals and schools; other military installations are today at times difficult to discover because of the profuse growth of tropical weeds. Native soldiers and labourers have gone back to their villages with much less permanent disturbance of mind and ideas than the administration expected. Dollars have virtually disappeared: an Indian woman in Fiji was recently brought to court and charged with not having revealed to the authorities the fact that she was in possession of the magnificent sum of six dollars in foreign currency. In Suva, Nuku'alofa, Apia and Avarua alike a constant complaint of the European population is the difficulty of securing vegetables, even native vegetables, at the high prices that are prevalent.

---

*This outline is one aspect of a report on fieldwork undertaken in the southwest Pacific from July to November 1948. The field project was made possible by a grant awarded by the University of New Zealand Research Grants Committee and was very materially assisted by the willing, expert and helpful cooperation of the administrative officials and staffs of the departments of agriculture in Fiji, Tonga and the Cook Islands, to all of whom grateful acknowledgement is extended.

[1] John Wesley Coulter: 'Impact of War on South Sea Islands', *Geogr. Rev.*, Vol. 36, No. 3, July 1946, pp. 409-419.

[2] Robert G. Bowman: 'Army Farms and Agricultural Development in the Southwest Pacific', *ibid*, pp. 420-446.

[3] Coulter: *loc. cit.*, especially pp. 411-416.

War Indirectly Accelerates Change

It is the indirect, subtle, and less obvious effects of the war that have had a more lasting effect on the people and the economy of the islands of the southwest Pacific. Whilst the patent disruptive influences have been withdrawn, they have left a legacy of inconspicuous effects that will continue for many years to impinge upon the social, economic and political development of the Polynesian and Melanesian peoples. Whilst the copra trade almost disappeared under the direct impact of war and the native agriculturist turned to the production of vegetable foodstuffs for the forces, the copra producer is already more prosperous again than he ever was before, and the service vegetable farms are today either abandoned expanses of weeds or have been returned to the cultivation of taro and tapioca. There are, however, indirect results of war's disturbance that are influencing the progress of agriculture and bringing changes in the traditional methods and objectives of native cultivation.

Agricultural change has been in progress in the southwest Pacific ever since whalers and missionaries first brought alien plants, animals, tools, methods and ideas a century and a half ago. There has been a gradual shift from a purely subsistence agriculture to one combining certain aspects of the old-time economy with the commercialised methods and practices of the alien immigrant culture; and this has accompanied the wider imposition of European civilisation upon a variety of differing native cultures, all of them so rudely dislocated in the nineteenth century.[1] In the long view the penetration of the commercialised economy of the West to the ultimate exclusion of the subsistence economy of the islands is inevitable except possibly in more isolated territories where conscious attempts are being made to resist the invasion, and where some success has already been achieved at striking a compromise between conflicting systems. The Kingdom of Tonga provides an example within the southwest Pacific of this latter exceptional situation.[5] Elsewhere native peoples have expanding wants which can be met only by entering to a corresponding extent into the larger commercial economy, and are themselves usually strongly averse to turning back the clock. The other island groups in the southwest Pacific furnish remarkably varied instances in all of which the discordant claims of the old and the new, of subsistence cultivation and commercialised agriculture and of European ways and traditional native customs exist side by side in unhappy association.[6] It may well be that, in a few years' time when the ephemeral and permanent effects of the war are more clearly distinguishable, it will be possible to demonstrate that World War II finally and irrevocably tilted the balance, and made it impossible to revert to traditional indigenous ways of life. Certain it is that what at the moment appear to be the more permanent consequences of the recent conflict are bringing about significant changes in southwest Pacific agriculture. Some of the contemporary changes were, however, already in evidence before 1939.

---

[1] The general problems arising from the 'sweeping' of native peoples in the Pacific 'from their circumscribed traditional settings of life into the larger world of contact and commerce' are remarkably well surveyed in Felix M. Keesing: 'Extension Work in Pacific Islands', *Rural Sociology*, Vol. 9, No. 4, December 1944, pp. 311-327.

THE CONSEQUENCES OF PROSPERITY

Indirectly the war has brought to island agriculture a prosperity rarely if ever equalled in the past—a prosperity that colours practically all features of the contemporary scene, excepting only in the islands of the southern Cook Group. The prosperity arises out of wartime destruction in other parts of the Pacific and its rim, and more directly out of the postwar shortage of, and enlarged demand for, certain tropical products. It is evidenced by the high prices that rule for copra, cocoa, bananas and rice. Western Samoa partakes of this prosperity through its production of copra and cocoa, Fiji through its export of copra and bananas and its increased production of rice, and Tonga because of its well-organised native production of copra. Only the Cook Islands, through persistent neglect of coconuts and the virtual

---

[5] See especially C. G. F. Simkin: 'Modern Tonga', *N.Z. Geographer*, Vol. 1, No. 2, October 1945, pp. 99–118.

[6] A valuable discussion of this situation in Fiji where it is complicated by the presence of a majority of immigrant Asiatics is provided by John Wesley Coulter: *Fiji: Little India of the Pacific*, Chicago, 1942.

Fig. 1. The coconut is not only the most valuable general purpose plant grown in the south-west Pacific islands, but the basis of the contemporary prosperity of native copra cutters and plantation owners. Many plantations, however, are ageing and others are weed-ridden. In some groups planting is being officially encouraged. This close-up is of a new heavy-yielding variety of short growing habit—the Malay Dwarf Hybrid. It is being widely planted by Fijians. (*All photos by Rob Wright, courtesy Fiji Public Relations Office.*)

disappearance of commercial banana production, have not shared in the recent prosperity and the progress that accompanies it. That the general prosperity will last some time is reflected in the ten year contract for copra offered by the British Ministry of Food, the widespread incidence of disease amongst West African cocoa trees, and the world-wide failure of food production to keep pace with the growth of population.[7]

Postwar agricultural prosperity has been accompanied especially in Fiji and both Western and American Samoa, by an increased urbanisation of native population and by the growth of industrial activity. (Urbanisation is also increasingly apparent in Rarotonga, although agricultural prosperity has not yet returned.) Domestic service, mining (in Viti Levu particularly), stevedoring, the civil service, teaching, medicine and commerce are absorbing more and more natives and

---

[7] Other observers however find 'the outlook from the commercial viewpoint . . . . . by no means promising'. See for example Keesing: *loc. cit.*, p. 326.

Fig. 2. The commercial product obtained from coconut is the dried meat—copra. The nut has to be cut in two and the white meat cut out of the shell. This is dried—sometimes in the sun, sometimes by artificial means. Coconut oil is now extracted from copra in Suva. The meat residue after oil extraction is a valuable livestock foodstuff.

Fig. 3. Copra is usually exported to the United Kingdom, Canada and the United States. In the foreground sacks of copra are being loaded. In the background drums of coconut oil and sacks of coconut meal are being put aboard . This is the main wharf at Suva, Fiji.

taking them from the villages and the land. It requires little sustained effort on the part of a family to cut and dry sufficient copra at today's prices to secure money enough to supply all the western foodstuffs, apparel and amenities for which the family now has the taste and desire. Among the consequences of this state of affairs is the increasing neglect of the customary family gardens, the occasional failure to grow adequate native foodstuffs, the further dissolution of communal and cooperative ways of life and a chronic shortage of labour on commercialised agricultural holdings and especially on European plantations. On the whole, village gardens are less well cared for and produce smaller quantities of taro, yams, kumara and tapioca, the four root staples upon which, in different combination, the people of the islands have long relied. So serious is this situation in parts of Fiji that the authorities are disturbed at the prospect of food shortages which would be disastrously aggravated should widespread hurricane damage be experienced. The wealth he derives from copra has led the Tongan cultivator to neglect increasingly that portion of his *abi* upon which he is accustomed to grow foodstuffs, so that the enforcement of food planting ordinances becomes more difficult, and even if these are carried out they do not necessarily guarantee that the tubers are brought to maturity and successful harvest. Consequently the European population of Nuku'alofa is required to spend even more time in its vegetable gardens than are New Zealanders.

Under these conditions the overthrow of traditional forms of agriculture is accelerated, and at the same time long-established European plantations go short of labour, and coconuts lie thick on the earth, often buried deep in a prolific growth of lantana, guava or elephant's foot (*Elephantopus mollis*). Despite record high prices, production is not expanding; locally it shows a significant decline, especially where plantations are ageing and replanting is out of the question because of the paucity of labour. European plantations are generally in decline in spite of the burst of postwar prosperity. In the Cook Islands (especially on Rarotonga) utter frustration and long-continued disappointment with prices and shipping facilities had put an end to the plantation system long before the war. In Tonga, leases to Europeans of large holdings worked on the plantation system are being withdrawn as they fall due for renewal. On Taveuni weeds are taking such a hold of coconut plantations established from fifty to seventy years ago that, with any marked recession in prices, declining yields would put an end to this form of commercialised agriculture. Labour will never be as plentiful or as cheap again as it was in the last period of low returns. Except on the Reparation Estates in Western Samoa, there has been very little planting of coconuts on European holdings in recent years. The biological control of the Levuana moth (which had made the copra industry almost impossible on Viti Levu) has resulted in considerable planting by Fijians of Malay dwarf hybrid coconuts in the last fifteen years, and in other groups (except only the Cook Islands) postwar prices have persuaded administrations to encourage by native planting regulations the establishment of coconuts.

Forms of Traditional Land Ownership Hamper Progress

With the passing of the plantation system and the continued disintegration of the indigenous communal subsistence economy, it is not yet clear what precise pattern of economy will take their places. It is obvious, however, that it must be based upon the soil and its cultivation, for, apart from gold in Fiji and decadent native handicrafts, the islands have no appreciable resources other than their still rich and partly virgin volcanic soil and their tropical climates. At the root of present and future agricultural problems is the conflict which exists between the persistent and inevitable drift towards a commercialised and individualised economy and the traditional tribal system of communal ownership of land. It is a paradox that Tonga, determined to retain Tonga for the Tongans, to preserve Tongan culture and to resist the irruption of western economy and civilisation in so far as this is compatible with Tongan welfare, has come nearest to a solution of problems of land tenure. This was done when, more than seventy years ago, it was decreed that every male Tongan on attaining the age of sixteen should have the right on request to the lease of eight and a quarter acres of land for life at a nominal annual rental.[8] Given such an individualisation of land in Fiji or Rarotonga, for example, where here is no rigid policy of restricting the penetration of European ommercialism or commercialised forms of agricultural production, he principal barrier against the change from an indigenous to an alien way of life would be down and the road open for these islands to fulfil

---

See 'An Act to Regulate Hereditary Lands Granted to Chiefs', *Government Gazette*, Vol. 2, No. 14, Nuku'alofa, 22 November 1882. Referring to this Act in his speech at the prorogation of the Legislative Assembly, King George Tupou of Tonga briefly summarised its beneficial social effects as follows: 'it is apparent from the regulations you have made . . . [that] you truly love the people of this land; and it is clear to me that it will be good for Tonga, that there will be neither a poor man nor a pauper in this kingdom: that if anyone be poor, it will be his wish to be poor through his own laziness in not using the opportunity which have [sic] been given him'.

what many consider to be their moral and social obligation of producing foodstuffs and tropical raw materials for the benefit of all.

Easing the Transition in Fiji

In Fiji a serious attempt is being made to find a solution to this problem, but in the Cook Islands an ineffectual effort is being made to prop up an archaic and involved system of tribal tenure. Several procedures have been adopted by the Colonial Government in Fiji recently to ease the transition and the travail that accompanies it.[9] It is officially recognised that a commercial and partly individual agriculture must succeed the ancient subsistence and communal system. Consequently native lands are being surveyed, consolidated and reserved with the object of facilitating their fuller use by Fijians according to the new commercial pattern. The Fijian Affairs Regulations 1948 extend and simplify the provision, made first in 1927, for the exemption of male Fijians from their traditional communal responsibilities and chores in the *koro*. The *roko* is now empowered to grant commutation of all social services and to issue a certificate to that effect. Commutation is granted on condition that a nominal monetary payment of £1 is made to the *koro*, *tikina*, or province that foregoes the traditional services. If subsequently engaged in agriculture the exempted man must practise sound and conservational husbandry and provide evidence that he has an annual income of not less than £50 from his individualised agricultural enterprise.

Further encouragement is afforded the development of commercialised crop production by individuals, family groups or *mataqali* by the passing of the Co-operative Societies Ordinance in 1947. This seeks to regularise the formation of associations of agricultural producers which are becoming popular and numerous amongst Fijians. The extent to which cooperative organisations of this sort might assist the administration in 'establishing an external exchange economy . . . . discovering internal and external markets . . . . raising the output of cash crops . . . . improving crops . . . . preserving the land . . . . [and] producing raw materials for export' is demonstrated by the activities since 1938 of the Fiji Co-operative Marketing Association.[10] This is an

---

[9] See 'Memorandum on the Fijian Affairs Regulations, 1948', Suva, 1948, for a brief outline of the principles underlying the present attempt to fashion a new life for the Fijian people that bridges the gap between traditional ways of life and life in the modern world. See also 'Report of Secretary of Fijian Affairs for the Year 1946', Fiji Legislative Council, *Council Paper No. 18*, Suva, 1947.

[10] See B. E. V. Parham: 'Brief History of Co-operation in Fiji', [Fiji] *Agric. Journ.*, Vol. 18, No. 1, March 1947, pp. 15-20.

sociation of exempted men with the objects of providing individual
rmers and family groups of producers with facilities for the culti-
ation, processing, grading, marketing and shipment of produce and
improving the agriculture of the Fijians and so raising their standards
living. In 1943 the association supplied no less than 4,634,400 lbs.
root and green vegetables and fruit for military purposes. With the
d of the war the society turned its attention to overseas markets
d in 1946 was already exporting bananas, pineapples, mixed fruit,
getables, peanuts, ginger and tapioca starch.

In Fiji much is being done to assist the Fijian people to meet what
e administration calls ‘the stresses and strains of modern economic
nditions’. In Tonga on the other hand the ‘stresses and strains’ are
ing resisted; commercial production is not encouraged. Copra is
lied upon to provide the individual native landholder and his family
ith such imported goods as are indispensable. Occasionally bananas
e exported, but when late in the war the British Government urgently
quested supplies of the bark fibre of the paper mulberry Tonga was
able to supply either then or subsequently. Under these circum-
nces the pattern of native agriculture remains much as it was three
nerations ago and commercial surpluses are few. A fraction of the
ongan’s eight and a quarter acre tax allotment is sufficient to produce
copra and his family vegetables, and he shifts his cultivation almost
nually by simply burning a small patch in some corner of his ‘farm’
in amongst his two hundred coconuts. His ancient ‘firefarming’ is
actised on an individualised holding.

The Misfortunes of the Cook Islands

Although the Cook Islands have always been well off the beaten
cks of the Pacific and although they were discovered relatively
e, the disintegration of the ancient economy has proceeded further
re than in the other island territories of the southwest Pacific. More
fortunate than this however is the fact that since the decline and
cay, between the two wars, of the European plantation system
d of the missionary-modified and partly commercialised native
onomy nothing constructive has significantly replaced the traditional
mmunal Maori agriculture that John Williams found. Shipping
ortages, depressed prices, uninspired administration and unimaginative
icultural policy have all long retarded the development of an alter-
tive economy, but community ownership of land remains the

principal barrier to the agricultural and economic progress of the Mao
people. Land is held by *arikis* or extended family groups. It is virtuall
impossible to secure agreement from all the many Maori individua
who own a block of 'customary' land to the lease of it to a Europea
or to secure their joint permission for one of their own number t
have the individual right to use one portion of it for commercial pu
poses. The land in consequence often remains unused or, at bes
seriously underused. In the immediate hinterland of Avarua and Avati
where alternative sources of income are offered by occasional work o
the wharf, by public works activities and by employment with th
department of agriculture, native cultivations are small, sporadic an
untidy. It is frequently difficult to discover the cultivated handkerchi
patches of tomatoes, watermelons, kumara and taro amidst the den
tangle of six-foot high weed growths—difficult even to trace t
narrow track from one patch to another through the tall tangle
second growth.

The exports of the Cook Islands are but a fraction of what the
were thirty-five years ago. Prompted by the decline in the productio
of oranges, the last of the significant export commodities, the admini
tration undertook early in the war to institute a replanting schem
hoping to replace the old diseased trees with small modern citr
orchards. Much of the fruit still comes from seedling fruit trees growin
haphazardly, many of them in the 'bush'. But the citrus replantin
scheme inevitably ran up against questions of land tenure. In additio
it was found difficult to persuade a once-agricultural people to unde
take a long-term replanting project, especially in view of the fact tha
because of a totally inadequate shipping service, they had in rece
years been obliged to allow as much as two-thirds of their oranges t
go to waste on the trees and a similar proportion of their tomato
to rot on the vine. The only serious attempt to rehabilitate nati
agriculture and to give the Cook Island Maori a livelihood as a
alternative to his demolished indigenous economy has not been a
unqualified success. In Rarotonga a hundred acres of oranges hav
been planted under the scheme and in Aitutaki a considerably small
area,[11] but to date practically all the work of clearing land, preparin
the soil, fencing, providing shelter, planting, weeding, mulching an
spraying has been done by the administration on behalf of the nativ

---

[11] 'Cook Islands [Annual Report] 1948', *Appendix Journ. House of Representatives*, (A-3), Wellingto
1948, pp. 16–17.

wner and charged against the future crop; and there is little evidence
at in most cases the work will ever be taken over by the individual.
ne Maori has largely lost his former interest in the utilisation of his
nd, and in Rarotonga agriculture and the land itself are in consequence
ry sick.

New Crops, Markets and Industries

It is in Fiji and Western Samoa that one must look for progressive
ange in agricultural economy; in the former case the progress is
gely that of individual cultivators, in the latter that of the Reparation
tates and private planters. Indirectly the war has helped by creating
w demands, new markets and new techniques. Fiji formerly imported
e rice consumed by its Indian population, but since supplies were cut
early in the war it has become almost self-sufficient in a foodstuff
nich is in much greater demand today than it was before the war
cause of the rapid increase in the Indian and total populations and the
owing popularity of rice amongst the Fijians. During and since the
ar Fiji has also been able partially to satisfy the demands of New
aland for groundnuts, tapioca, ginger and coconut meal formerly
tained from a variety of other sources. The production of pineapples
s also expanded and the canning of both pineapples and pineapple
ce is largely a wartime growth. The irregularity of shipping and the
rtage of shipping-space in recent years help to explain the marked
elopment in the processing of agricultural products in both Fiji and
moa. The manufacture of banana figs and of desiccated coconut
s contributed appreciably to the economic prosperity of Western
moa. In 1943 the value of desiccated coconut exported was £8,686;
1947 it reached £79,249. Dried bananas first figured in the export
of the mandated territory in 1946: in the following year eighty-
ur tons valued at nearly £20,000 were exported.[12]

Milling 20,000 tons of rice from nearly 30,000 acres is a new industry
Fiji. The drying of bananas has just been introduced and the canning
pineapples and fruit juice expands. The Fiji Co-operative Marketing
sociation is at present constructing a mill for the extraction of
ioca starch. Guava jam is being made from the fruit of one of the
lony's most serious weeds. Oil is extracted in Suva from candlenuts
llected in Fiji and other islands for use as a substitute for linseed oil.

---

wenty-fifth Report of the Administration of the Territory of Western Samoa, 1948', *Appendix*
urn. House of Representatives, (A-4), Wellington, 1948, p. 25.

The possibility of dehydrating the traditional bulky root crops i being discussed, especially since a reserve stock of such food would be o very great value should a hurricane devastate any considerable area o growing crops in an island group where population is increasing mor rapidly than the supply of foodstuffs. Food storage in island climate remains a significant problem. The greatest single developmen however, in the processing locally of agricultural raw materials is th establishment in Suva of a factory able to express annually the oil fron 15,000 tons of copra. Oil and coconut meal are now exported in larg quantities, but it is hoped ultimately to refine, deodorize and harde the oil and also to manufacture margarine in the colony. America Samoa has been chosen as the site for a tuna and other fish cannin industry. The fish are to be caught by modern large-scale methods particularly off the northwest coast of Viti Levu and about the Yasawas and transported to American Samoa in refrigerated vessels for cannin and subsequent export to the United States.

Animal Husbandry Neglected

Pastures and livestock are not conspicuous features of the agricultura landscapes of the tropical islands of the southwest Pacific. In the las few years, however, considerable attention has been given to th possibility of extending animal husbandry. Medical opinion in th islands insists that with the rapid increase in population and the apparen general decrease in the amount of fish available, and partly because o the tendency of the native people to neglect the ancient art of fishin in which they were so eminently proficient, the diet of the islander has become unbalanced—deficient in protein and oversupplied wit starch from root vegetables, sugar, flour and ships' biscuits. The nee for animal proteins, especially amongst the youngest of the population is urgent. The increasing cost of bully beef and other tinned meat which the natives prefer to fresh meat, is diverting their attention to th latter, with the result that in practically all islands it is in markedl short supply. In this respect (and in others) the recent adjustment of th rate of exchange of the New Zealand pound will have repercussion throughout the islands—and in the export trade of the dominion wit the island territories.

On Viti Levu alone have serious attempts been made to establis pastoral industries and only in Fiji does the administration employ veterinarians and livestock officers and supply technical advisory an extension services for the pastoralist. Although Viti Levu supplie successful examples of large and small-scale dairying operated by Europeans, Indians and more recently by Fijians, and one or two cases of extensive beef-cattle rearing in the dry zone, although thousands of Indian peasants graze on the roadside an odd dairy cow as well as their zebu-cross working bullocks, and although many Madrassis keep large herds of goats and all Fijian *koros* have their pig population, the supply of milk and meat available is insufficient to meet the present demand, and quite inadequate in the estimation of medical authorities for the dietary requirements of the population. Labour problems and the encroachment of weeds have resulted in a decrease in the cattle kept on Taveuni's plantations, and this source of fat cattle has almost disappeared. Consequently encouragement is being given to Fijians to become independent dairymen supplying the dairy factories at Navua and Rewa, and under the colonial development plan it is proposed to establish on 60,000 acres of hill country in the Ra province a beef-cattle rearing project on a larger scale than that already operated on inferior and drier pastures by the Colonial Sugar Refining Company at Yaqara.

In conjunction with such established and proposed livestock enterprises the Department of Agriculture is conducting research with the object of discovering the best pasture grasses for the variety of wet and dry situations that the islands of Fiji present. Much experimentation is being pursued in the hope of finding suitable legumes for tropical pastures. Amongst grasses, batiki blue grass (*Ischaemum aristatum*) in the wet zone and *Dicanthium* spp. in the dry zone show much promise; amongst legumes limited success has been achieved with species of *Desmodium*, *Pueraria*, *Alysicarpus* and *Stylosanthes*. Indispensable also to the future success and extension of the pastoral industry is instruction in the better management of pastures under tropical conditions, and attempts to combat the menace of weeds.[13] In Fiji both are being actively undertaken.

In Western Samoa over 9,000 head of cattle are run on the Reparation Estates principally with the object of keeping clean the copra plantations and so reducing the difficulty of recovering the fallen nuts. For many years these cattle were given little or no attention and almost ran wild, with the result that the degree of constitutional deterioration under tropical conditions was very great. But, with the shortage of meat, and an assured market for it in Apia, thought is at last being given to the improvement of the herds. The few European planters on

---

[13] B. E. V. Parham: 'Weed Control in Relation to Pasture Management', [Fiji], *Agric. Journ.*, Vol. 16, No. 2, June 1945, pp. 60–68.

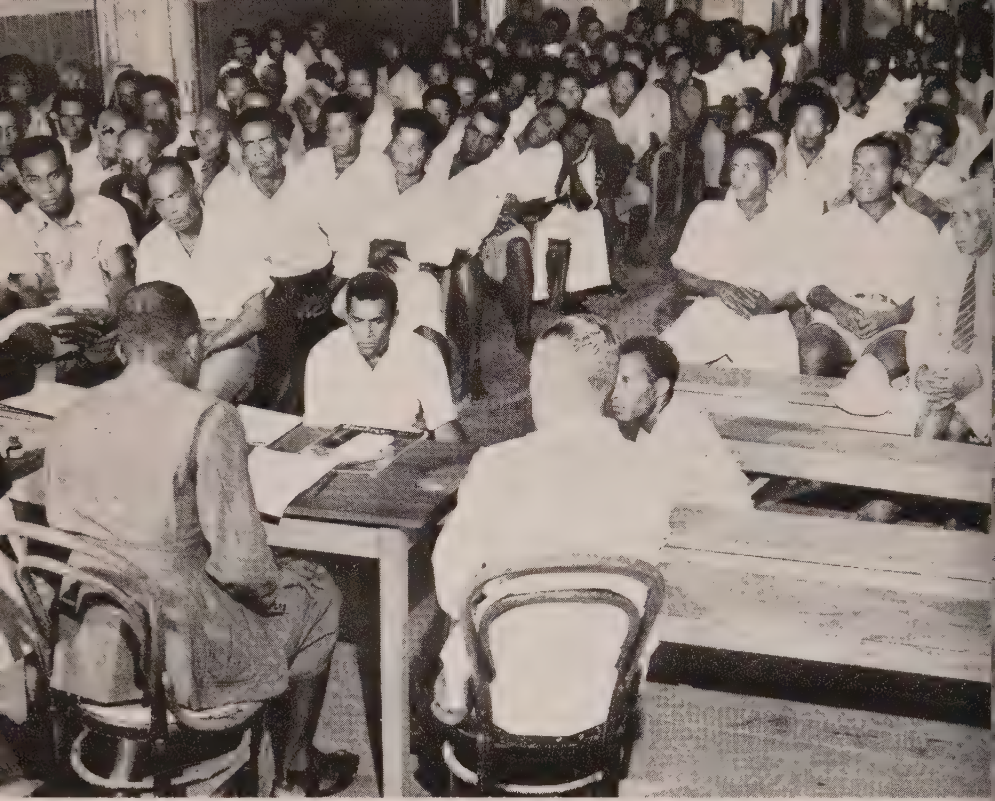


Fig. 4. A modern form of the ancient cooperative village life of the Fijians is the development of commercial cooperative societies for the procuring, grading, marketing and shipping of the economic products of native agriculture. These societies are beginning to play a large part in the life and economy of the Fijian people. This photograph shows in progress an annual meeting of a cooperative society at Nausori, Viti Levu.

Tongatapu also run small herds of station cattle for similar purposes but under better conditions. Here temperatures are not nearly as high and rainfall is less than in either Fiji or Samoa. Given research and experiment it should be possible to replace the prevalent Vailima grass (a name given to both *Axonopus compressus* and *Paspalum conjugatum*) and sensitive plant (*Mimosa pudica*) with better grasses and legumes (possibly including those that have more recently proved of value in the northernmost parts of New Zealand). Unfortunately the administration shows little interest since livestock rearing does not appeal to the Tongan who is wedded to his shifting cultivation of food crops, and the European planter sees little security of tenure on his leasehold. The Cook Islands have few livestock, and although the potentialities of pasture establishment are physically comparable with those of Tongatapu, bully beef, ships' biscuits and taro (or kumara) are rapidly becoming the staple trio in the diet of the Rarotongans.

THE WASTAGE OF RESOURCES

The progressive destruction of ancient tribal restraints and taboos

ig. 5. On Viti Levu bananas are the chief commercial product of native cultivation and village ardens. From riverbank villages they are transported downstream on bamboo rafts and at some onvenient assembly point the bananas are cut from bunches and packed in cases either in clusters hands') or singly ('fingers'). An increasing proportion of bananas for export is being handled y commercial cooperative enterprises. This packing station is on the Wainimbuka River, tributary of the Rewa.

hat once regulated the planting and harvesting of crops and ensured hat resources of vegetation and soil were maintained for the enjoyment nd support of future generations is responsible for certain cumulative and problems now coming to light in the southwest Pacific. The artime acceleration of the disappearance of the taboos that thickly ncompassed traditional agricultural practice, and that more often an not were based upon hard-won experience and lengthy observation f nature, together with the postwar shortage of foodstuffs, have evealed all too clearly the destruction of natural resources which ccompanies the transition from indigenous to introduced economies. all the territories serious conservational problems are present. Only Fiji are they widely appreciated and are conservational policies eing adopted.

All the island groups within the southwest Pacific, excepting only ne minute coral atolls, have soils and climates conducive to a dense atural cover of forest. Even in the dry zones of Viti Levu and Vanua evu, the *vanua singasinga* (or 'open land', largely free from trees) has a forest potential, so that its gramineous cover is perhaps best considered to be induced. It is therefore surprising to find that there is a serious shortage of timber in all the groups. The Cook Islands, Western Samoa and Tonga are already in the paradoxical position of being unable themselves to find locally the small timber necessary for the manufacture of the boxes and cases in which they export their fruit surpluses, and of being obliged to import shooks of *Pinus radiata* cut from the timber of introduced trees grown in New Zealand. From the point of view of the economy of the islands another significant factor is that the imported cases often cost as much as the value to the native grower of the bananas, oranges or tomatoes that he puts into them. In Fiji the shortage of case timber is approaching the point where importation will soon become necessary.

Soil Erosion in the Southwest Pacific

Concomitant with the wastage of the forest cover is the even more serious problem of soil erosion. Only Tongatapu with its deep soils and absence of slopes and its but slightly modified indigenous methods of shifting cultivation has no soil erosion problem, although incipient sheet erosion is already evident on the sometimes steep slopes of Eua and Vava'u. In Rarotonga and Upolu[14] fire has recently been used indiscriminately to destroy thousands of acres of forest land on many of the ridges that in both islands run back from the coast or the narrow littoral tract. In Rarotonga repeated firing by irresponsible youths, freed from the ancient tribal restraints, has not only destroyed the forest on these ridges but has also led to such serious loss of soil that the forest potential has probably been destroyed and the cover semipermanently changed to one of stunted fern growth. It is of interest to notice that in the dry zone of Viti Levu, where burning of the induced grass cover has been oft-repeated, the same species of fern (*Gleichenia linearis*) is the dominant plant on what is locally termed *vanua talasinga* ('sun-burned land'). This plant is not only an indicator of burning but also of advanced soil erosion.

In Fiji soil erosion is most serious on better land where commercial forms of agriculture are practised, although native cultivation of *teitei* on the steepest available slopes in the wet zone leads occasionally to disastrous losses in heavy rains. The general manager of the Colonial Sugar Refining Company has himself drawn attention to the soil erosion prevalent on the cane lands.[15] On the poorer rolling land, on which most of the contract cane suppliers operate, losses are more serious than on company land leased to tenants. But the most criminal destruction of soil resources in Fiji is taking place within a few miles of Suva where Indians, Chinese and some Fijians are cultivating shallow soils on short but steep slopes and growing row and other crops for the urban market and for export. In many instances the cultivation of pineapples, taro, yanqona, Chinese cabbage, tomatoes, tobacco and a range of European vegetables has reduced what was, little more than a generation ago, a thin but rich soil with a dense cover of rainforest to an untidy broken expanse of low hills with handkerchief patches of built-up gardens, bare raw stretches of soapstone and abandoned tracts of noxious weed growths.

---

[14] Soil erosion is reported also in American Samoa. Here it is the repeated use of forest clearings at greater and greater distances from the village and on steeper slopes together with burning that lead to losses of soil. See John Wesley Coulter: 'Land Utilization in American Samoa,' Bernice P. Bishop Museum, *Bulletin No. 170*, Honolulu, 1941, especially pp. 28-29. See also *idem*: 'Changes in Land Utilization in South Sea Islands', *The Scientific Monthly*, Vol. 55, No. 7, July 1942, especially pp. 63-65.

Fortunately the authorities in Fiji are aware of the menace of soil erosion and are doing what is possible with limited means, equipment and personnel to foster soil and vegetation conserving practices. Other administrations, although possibly aware of the dangers, have not as yet taken steps to counter the threat. It is obvious however that in years to come both the introduced commercial forms of agricultural practice and the modified indigenous methods must be adapted to include the use of soil conservation techniques and to avoid burning, clean-weeding, up hill and down hill cultivation of row crops and other habits that have caused such serious and widespread damage in the relatively short time since alien practices came to disturb and sometimes to oust the traditional ways.

RESEARCH AND EDUCATION ARE URGENT NEEDS

In this matter, as in so many other aspects of the changing agricultural economy and practices in the islands of the southwest Pacific, the fundamental and urgent need is education. To teach the native people (and those immigrant peoples with low standards of education) the proper use of conservational techniques and improved practices is a difficult matter and quite different from the instruction, for example, of the farmers of Australia and New Zealand. There is room in all the territories in question for more and better instruction in agriculture at all levels. In some groups there is at present but the minimum of agricultural education in native schools and practically no extension service for native cultivators. It is perhaps more important that at this particular stage in the transformation of indigenous economies there should be a very considerable expansion of demonstration work (to show the native gardener how to grow commercial crops, establish pastures, care for livestock, plant shelter and timber trees and practise conservation) than that there should be elaborate research without extension. Much research has already been conducted in Fiji and Fiji has made much greater efforts to extend the results and benefits of such research to the cultivator. It would be a great advantage if the research already conducted should be made available to all groups and if the experience of all administrations which are attempting to instruct the native farmer could be shared.

---

[15] Quoted in 'Editorial', [Fiji] *Agric. Journ.*, Vol. 19, No. 1, January 1948, p. 1.

In the longer view, however, research is imperative if the island people are to pass successfully through the throes of the transition from a subsistence to a commercial economy and are to emerge as participants in an international system of exchange in which their resources are enough to ensure them much higher standards of living than they now enjoy. It would seem appropriate, in view of past experience, if the recently-constituted South Pacific Commission could formulate a long-term research programme, thus avoiding duplication of effort in more than one of the small territories concerned and concentrating funds and personnel on those problems which are significant to the island territories as a whole. Basic to any successful research programme into land problems of this sort are fundamental surveys of the present position—of the resources of soil and vegetation available for use, of the contemporary use or misuse of land and of the distribution and morphology of soil erosion—with the object of classifying land so as to plan and determine the better its most fitting future use. Topographic maps and aerial photographs of the islands in question are few. Before research already under way (such as soil surveys in Fiji), research that is projected (such as the geological surveys of Fiji recently proposed) or research still to be planned by the South Pacific Commission—before any of this work can be carried out efficiently, smoothly and with the utmost despatch, deficiencies in the technology of research and the lack of basic tools must be overcome. The mapping of soils, vegetation, soil erosion and land utilisation is indispensable to the better use in future of land in the islands of the southwest Pacific. In such fact-finding the services of New Zealand geographers should be of great value. The many islands in which the dominion is directly and indirectly interested —New Zealand's 'Pacific island neighbourhood'—present scientists in general with remarkable opportunities.

THE GALATEA BASIN: A GEOGRAPHIC RECONNAISSANCE[1]

JAMES W. FOX AND R. G. LISTER

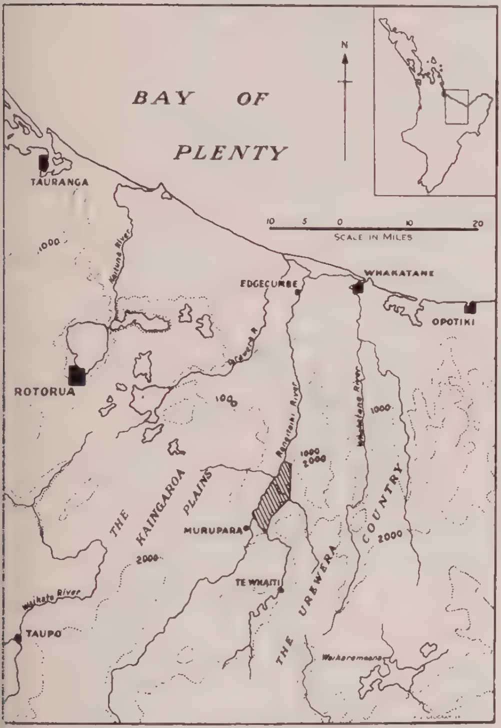


Fig 1. The shaded area shows the location of the Galatea Estate.

THE ROAD from Rotorua to Wairoa, having crossed the Kaingaroa Plains, winds steeply down through the forest margins to an open level plain some four to five miles wide, across which the bold dark lines of shelterbelts intersect a variegated pattern of fields. This is the Galatea basin, which stretches away to the north for a dozen miles, overshadowed to the east by the abrupt slopes of the ranges of the Urewera country and dominated to the west by seemingly limitless conifer forest, the dark, even skyline of which is broken only by Tarawera and Mount Edgecumbe. The monotony of the western border is in vivid contrast to the broken ranges of the east that tower behind their first great spurs to magnificently bush-clad crests over three thousand feet in height.

The vast acreage of exotic conifers which constitutes the western boundary of the region is to be the scene of immediate development. Plans include the erection at Murupara of a large modern pulp mill linked by a new railway to the Bay of Plenty ports. The presence of a new town, built to serve the mill, will reorient the farming of the basin, and within a short space of time the intensive land utilisation of this area will be substantially extended. A particularly interesting stage in the evolution of the region has thus been reached. The former extensive sheep-raising economy is giving way to intensive dairy farming on land which must, in this respect, be classed as marginal, and with the establishment of an urban group a further modification of the farm economy will ensue.

---

[1] This investigation is based upon a detailed recording of land utilisation in the area made in the field early in 1948, the base map being compiled from air photographs, farm development plans and original field sketches. Valuable assistance in mapping land use field by field was rendered by a party of four Stage III students of the Department of Geography, Auckland University College.

The Galatea basin owes its formation to major structural down-faulting aligned approximately north to south along the western flank of the eastern mountain axis of the North Island, and to the infilling of the depression between the fault edges of the ranges and the volcanic plateau to the west. On closer examination the almost level appearance of the floor of the basin is seen to be a result of the interaction of several processes. Structurally the basin floor possesses characteristics that have contributed fundamentally to its agricultural potentialities and existing land use. Considerable depths of water-sorted pumice, deposited after major eruptions from Taupo, underlie the present surface. Rapidly washed off the steeper slopes of the ranges, this sandy rhyolite-pumice overloaded the streams, and was spread out across the earlier alluvial deposits of the basin to give the landscape its basic feature of a gentle slope from the south towards the north and west. Subsequently the major streams carved out a series of terraces, and the whole has been mantled by a succession of recent ash showers to a depth of five or six feet.[2] These reveal the contour of the old surface on which they lie and give to the subsoil particularly important characteristics which are vitally significant in the agricultural utilisation of the area. The mantle is also mainly of Taupo material, and includes a bed of fine chocolate-brown pumice, sandy silt or sandy loam in texture, which occurs throughout the basin on all terraces and levels except the present river-bottoms and the alluvial fans below the eastern ranges. This well compacted layer is of prime importance to the farming of the region since it retains moisture, although its average distance below the surface of two feet six inches makes it inaccessible to all but deep-rooted plants. Above this chocolate-brown layer occurs a succession of more loosely consolidated pumice beds upon which is developed four to six inches of relatively poor soil (*Fig.* 6). In the northern part of the basin however, a modification is found. As far south as the junction of the Rangitaiki and the Horomanga, the soil is darkened by the presence of

---

[2] See L. I. Grange: 'A Classification of Soils of Rotorua County', *N.Z. Journ. Sci. & Tech.*, Vol. 11, 1929, pp. 219-228, for an account of similar conditions to the west.

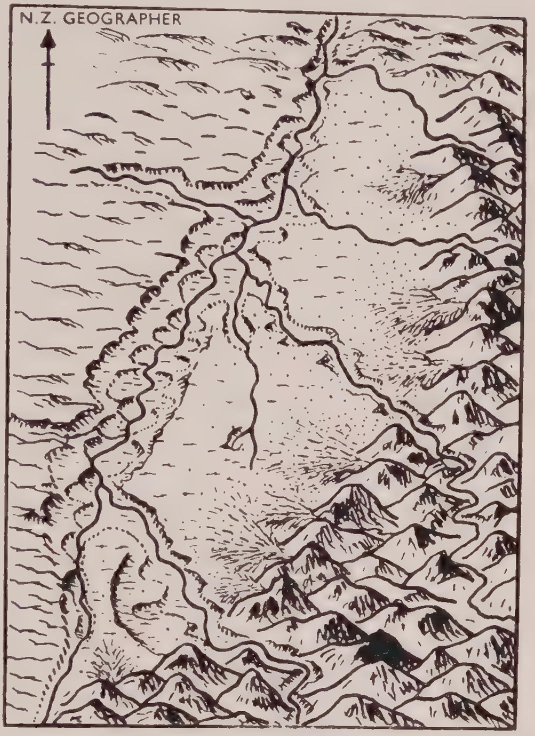


Fig 2. The Galatea Basin.

basaltic scoria fragments, the size of peas or even smaller, originating from the Tarawera ash shower of 1886. These rough pellets do not constitute a measurable horizon, but are already breaking down into what farmers claim to be a valuable constituent of the soil.

Numerous small streams flowing from local watersheds between the towering spurs of the eastern ranges have disgorged their loads of pumice, gravel and greywacke fragments in alluvial fans which sprawl out for over a mile on to the plains, and mask the regular succession of recent ash showers below (*Fig*. 2). The fall in level across the southern part of the Galatea estate from the head of the fans to the road four miles to the west is of the order of two hundred and sixty feet, half of which takes place in the first mile. This degree of slope is not maintained, however, in the central part of the basin, where the greater width contributes to the occurrence of ill-drained peaty areas on both sides of the Horomanga. Few of the streams maintain their flow across the fans during the summer months, but the water they bring into the basin reappears in a series of springs which supply the central and northern areas, whilst in the south this water permeates throughout the subsoil and in even the driest seasons maintains the moisture in the chocolate-brown pumice layers. The Rangitaiki and its main tributary, the Whirinaki, today meander along the western side of the basin between terraces totalling twenty-five feet in height, until the unction of the Horomanga Stream is reached, after which point the river is less deeply incised. It finally plunges over ignimbrite sills in rapids and falls to leave the basin by a gorge at the northern end (*Fig.* 5).

The region has an annual average rainfall of over fifty inches,[3] and the ranges of the Urewera country, presenting their rugged flanks to the westerlies and northwesterlies, probably cause a precipitation almost twice this total in the headwaters of the rivers flowing into the basin. Averages show an even distribution throughout the year, with no monthly figure below three and a quarter inches. Characteristically, however, the monthly fall is very unreliable; almost any month may be the driest of the year, and at any time there may occur intense local storms which deluge a parched countryside, swell the rivers to the limits of their lower terraces, hinder communications and, in general terms, bring little relief to the farmer's anxiety. Raw slip scars on the steep faces of otherwise scrub-covered spurs overlook the southern end of the basin. These and the Bailey bridge which spans the Whirinaki (replacing an earlier structure swept away) are reminders of 17.19 inches recorded in a three-day period during February 1944. Summer months bring hot, dry days that produce adverse effects on the better quality pastures, and have resulted in the use of mixed grasses in Galatea, so that danthonia, paspalum, cocksfoot and crested dogstail are among the dominant species during these months. The ryegrass and clovers however have proved remarkably resistant to the local conditions of light, dry soil and they come away with fresh vigour in the following spring. Cool nights during the summer months are characteristic and the resultant heavy dews contribute small but valuable amounts of moisture. Frosts may occur at all times of the year and become frequent and severe in the winter months. The annual average number of sixty ground frosts on the volcanic plateau[4] is probably not a fair indication of the frequency with which frosts occur locally in the Galatea basin. Snow which lies on the hills to the east does not settle on the plain below, but strong winds are common across the flat and reach gale force most often from the northerly direction. They demand special attention to the problem of shelterbelts.

Under these local conditions of soil and climate, Galatea seems to have carried a vegetation cover similar to that of the Kaingaroa Plains to the west, although it was somewhat denser. The dominant species

---

[3] Records taken at Murupara show an average figure of 50.93 inches over the period 1933-1947, the minimum being 36.17 inches in 1937 and the maximum 60.09 inches in 1944.

[4] E. Kidson: 'The Frequency of Frost, Snow and Hail in New Zealand', *N.Z. Journ. Sci. & Tech.*, Vol. 14, 1932, p. 42.

Fig. 3. The Galatea Basin from the Forest Lookout at Pekepeke. A well-defined basin between the plantations of the volcanic plateau and the scrub and bush of the ranges of the Urewera country.

were manuka and tussock grasses (*Danthonia raoulii var. rubra* and *Poa caespitosa*). Pond and MacLaurin[5] in 1900 observed these to constitute a comparatively sparse cover on the Kaingaroa Plains; in Galatea, however, they formed a more continuous carpet. The podocarp forests of the ranges do not appear to have colonised the pumice of the plain.

Early penetration by white settlers was precluded by the location of the area to the east of the volcanic plateau, and probably the first pakeha to arrive were the members of a small military force sent during the 'sixties of last century. On the western bank of the Rangitaiki, some three miles north of the present settlement at Murupara, they established a fort as part of the general policy of containing the Maori within their own stronghold areas. One of this body, Hutton Troutbeck, forsook the colours on the withdrawal of the force and stayed in the valley, having acquired the greater part of the basin from the Maori, who appear to have settled here only in recent years. He utilised the whole of his property—almost thirty thousand acres north of the Whirinaki—as an extensive sheep run, adding horse breeding for the Indian Army at a later date. He built his homestead in the southeastern corner of the run, and named it 'Galatea' after the ship that had brought the troops to New Zealand. The homestead buildings, with the large woolshed and shearers' huts near by, are today surrounded by several acres of flourishing exotic trees which were planted by Troutbeck.

Conservation measures had no place in the economy of the station. Attempts to modify the natural vegetation cover consisted entirely of firing the manuka which would reestablish itself as dominant within four or five years. The burns were allowed to sweep up the steep faces of the eastern spurs and to drive back the bush on the exposed slopes.

J. A. Pond and J. S. MacLaurin: 'The Composition of the Soil of the Taupo Plains, and its Suitability for the Growth of Grasses', *Trans. and Proc. N.Z. Institute*, Vol. 32, 1900, pp. 227–242.

In the damper valleys between, however, the bush has remained as downward thrusting tongues from the crests behind. With such routine treatment, and with overstocking, the better constituents of the tussock association were steadily driven out and the native fertility of the basin depleted. A carrying capacity of thirty thousand sheep in earlier decades was reduced by a third. Yet Galatea continued to exist primarily as a sheep station, sending its animals on a three-week droving journey across the plateau to the Morrinsville yards, until 1931, when the government purchased the property.[6] At this time the station supported a population of sixteen, all of whom were Maori except the station manager and his family.

From the first the government, through the Department of Lands and Survey, intended to develop the basin as a dairying region. The pastures were renewed before the farms were offered for settlement, and meanwhile the ever-diminishing sheep station was run at a minimum cost. The isolation of the district was considerably reduced when work was begun on a road to the Bay of Plenty, hitherto economically impracticable because of the Waiohau Bluffs lower down the Rangitaiki. Here a cutting in the cliffs above the river was blasted to bring the road through from Whakatane during 1932. Roading in the station area itself was also undertaken to link the proposed farms both to the new road and to the older Rotorua highway. This local work, together with scrubcutting, fencing and cultivation preparatory to grassing, occupied fifty men; and in addition a small demonstration and experimental farm was established in 1933. The success of the department's endeavours is reflected by the cultural landscape of the basin today.

Meanwhile, to the south of the Whirinaki in the southern part of the basin, an area of crown land comprising 1300 acres capable of close dairying settlement had been put aside for the use of the Small Farms Board. This body was set up in 1933 during the difficult years of

---

[6] 22,175 acres were purchased for £94,665. The remainder of the estate was retained by the station manager who still farms in the area in which he has lived since 1891.

the depression to promote farm schemes on lighter marginal land which would entail no very arduous initial clearing. Here the unemployed men who were engaged to carry out the improvements in the first stages were given preferential treatment in the allotment of the sixty-acre dairy farms. The subsequent history of this Murupara block is different in some respects from that of the Galatea scheme and has resulted in certain distinctive characteristics, particularly in the size of holdings.

At about the same time the Department of Native Affairs had assumed control of the area which lies between the Rangitaiki and he state forest and which extends along the south bank of the Whirinaki between the river and the main Rotorua highway. Here an attempt was made to encourage the Maori to farm the river terraces where ome of the best-watered land is to be found. The Maori were brought rom scrub-infested lands several miles higher up the Rangitaiki. Two pa were built as the foci of settlement and dwelling houses erected t regular intervals along the stretch of land controlled by the department, although individual properties were never made over to families s farm holdings. The whole remained vested in the central organisation.

The landscape of the major part of the Galatea basin today is ssentially the product of these recent schemes. The region in general, nd the Galatea estate and the Murupara block in particular, have cquired a personality which differentiates them from other pioneer airy farming districts in the North Island, and which is characterised nore especially by the development of a farm economy based primarily n lucerne and by the utilisation of a terrain with peculiar conditions f climate and soil. Lucerne dominates in such a way that the success or ilure of most holdings may be measured in terms of the efficient roduction of this crop. Visually, too, the fields of lucerne constitute ne most striking feature of the landscape, especially when the basin is iewed from the bordering spurs. The patchwork of dusty, parched elds is chequered by the vivid green of the lucerne confined in rec-

Fig. 4. The Galatea Basin from the Eastern Spurs. In the distance the mass of Tarawera and the cone of Mt. Edgecumbe. Shelter belts, rectilinear fields, straight roads and the gravel wash of the Mangamate tributary constitute a landscape essentially man-made.

tilinear masses on the Galatea estate but of more irregular scattered shapes on the Murupara block. It is in summer that the growth is most vigorous, providing adequate feed at this critical period when other pastures are falling off. The experimental farm had shown how successfully this legume could be cultivated and utilised, and it was accordingly taken up by some of the first sharemilkers, who came to appreciate its full value during the droughts of 1937 and 1938.

After the initial success, sowing continued almost every year. Where there were once small expanses of five acres there are today as much as seventy, the result of twelve years' work. That some of the earliest pastures are thinning out and need reseeding is to be expected, but it is significant that on practically every farm established in the first days of the Galatea scheme approximately one third of the land is now under lucerne. The distribution of small paddocks of lucerne along the Whirinaki and Taranui Roads north of the Whirinaki is ample evidence of this (*Fig*. 8).

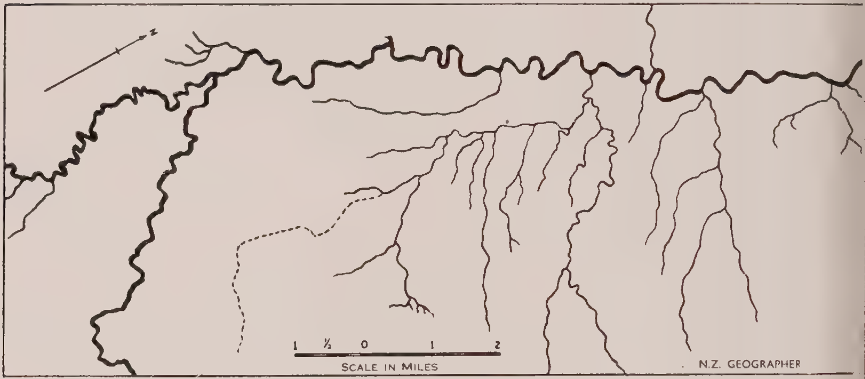


Fig. 5. Main Drainage Pattern. The broken line represents the gravel wash.

Moreover, this indispensable fodder crop benefits the soil by increasing the relatively low nitrogen and poor humus content, and for this reason alone its cultivation and rotation round the farm appears desirable to most farmers. However it is not a simple matter to put in lucerne because of the peculiar climatic and edaphic factors which obtain over much of the area. Sown in October or November, it has not always proved itself capable of resisting competition by weeds or of withstanding the vagaries of climate during the critical first year. Even though the initial problems may be solved largely by the use of inoculated seed, the danger of complete loss remains whilst the young plants are sending down their deep roots through the loose subsoil to the moisture-laden brown pumice layer below. But once this has been reached the plant comes away rapidly and a dense growth is obtained for an almost indefinite period, despite four, and sometimes five, cuts in the summer half of the year.

Fields of lucerne with their attendant hay and silage stacks have therefore become the salient features of the agricultural landscape in the two development areas. On the Murupara block between the Rotorua highway and the Rangitaiki, individual enclosures of lucerne are smaller and their pattern of distribution more open than on the Galatea estate where such paddocks are larger, more frequent and often continuous. Yet in both, the fenced areas are characteristically small in contrast with the wider expanses found further north towards the central part of the basin which is now being developed as a dairying region. Here much of the land still awaits subdivision, and the large stretches under lucerne and arable crops represent the preliminary steps in the stablishment of the farms. The object is to create a reserve of feeding tuffs for the new settlers and to provide on each new holding a stand of at least thirty-five acres of lucerne. Beyond the Haumea Road ucerne is virtually absent as a feature of the landscape, but reappears in wo areas, one on the northern margin of the basin, the other towards he northwest along the edge of the state forest. These two 'outliers' re of comparatively recent date, are the result of private efforts to stablish dairy farms, and are quite distinct from the official soldier and ivilian settlement schemes to the south. A further contrast is evident n the smaller proportion of lucerne to grassland, for here sown pastures re better watered.

This distinction is, in fact, a cardinal point. The distribution of ucerne is evidence of the dependence upon it of the Murupara and Galatea dairying regions, essentially as a summer feed, but in the entral part of the basin springs emerging from the base of the alluvial ans and a higher water table have contributed largely to the creation f better swards more resistant to summer drought. The cultivation of ucerne, therefore, tends to disappear in this area, and pasture, often ough, assumes a greater significance.

Yet lucerne is not the only fodder crop. The pattern of distribution f arable land under field crops shows a marked correlation with that f lucerne (*Fig.* 8). Every dairy farm has several acres under swedes to urnish a supplementary winter feed, whilst on the open undeveloped

Fig. 6. A Typical Galatea Soil Profile. The successive pumice layers are easily discernible, with the main chocolate-brown layer at the bottom at a depth of 27-30 inches.

lands of the central section extensive areas are under roots. In the latter case the purpose is twofold, to clean the land before regrassing and to provide winter feed for the station herds and flocks.

Nevertheless grassland constitutes the basis of the farm economy in the Galatea basin, for the dominance of lucerne is essentially that of a key crop which tides the dairy farmer over a critical period. In terms of area pasture land is by far the most extensive and will probably always occupy at least half of the dairy farm acreage. Today that proportion is approximately two-thirds, and consequently a map of the land utilisation of the Galatea and Murupara dairying regions demonstrates the areal significance of grassland (*Fig.* 9). Again in these two regions the subdivision into small paddocks is brought out by the pattern of distribution and is in direct contrast to the extensive pastures of the terraces along the Whirinaki and the Rangitaiki and of the southeastern, central and northern portions of the basin. Much of the pasture in the last two areas offers a further contrast in that it may be categorised as rough.

The classification into either permanent or rough is based on two major precepts, the proportion of weeds and the character of the terrain. In the central and northern areas much of the land still remains unimproved, is infested with weeds, and possesses a surface broken by river terraces and patches of swamp. The poorer types of grass dominate, particularly danthonia. This rough pasture is again significant along the Rangitaiki and the Whirinaki, and in parts is so densely covered with manuka that it becomes scrubland. On the Murupara block the fields bordering the eastern spurs are being steadily overwhelmed by the scrub which is reclaiming the land. Many paddocks show an infestation by weeds of more than fifty percent and so fall within the category of rough pasture.

On the other hand, where sown pastures have been maintained y topdressing they are classed as permanent. The better lands of the ld station which are found in the southeastern part of the basin near he Galatea homestead are noteworthy in this respect, as are the pastures etween the Galatea Road and the Rangitaiki, but especially so are the wards of the dairying areas. Constant application of fertiliser is necessary o keep up the quality of the dairy pastures which are mainly of rye-rass and clover with admixtures of paspalum, cocksfoot and sweet ernal. However, the occurrence of permanent pasture along the left ank of both the Whirinaki and the Rangitaiki is not always a true ndication of the quality of this particular grassland, for the Maori re not maintaining the sward and are content to let nature provide. ome parts have already reverted to rough pasture and scrub.

On the actual floor of the basin scrub cover is seldom of importance. Along the streams flowing to the Rangitaiki north of the Horomanga here are some large patches which are relics of a former more extensive over and which are being cleared as the initial stages of development roceed (*Fig.* 10). The courses of the two main rivers are picked out by crub cover, both native and exotic, and also in the case of the Rangi-iki, by stands of willows. The most striking feature of all, however, the pattern of shelterbelts. These long lines of poplar and *Pinus diata* stretch from the eastern spurs to the Galatea Road, sometimes eyond, and elsewhere line the roads or boundary fences. Smaller ersions, found on the older established farms, are giving a new face the landscape as, pushing rapidly upwards, they more and more estrict the view to a few well-tended fields. Plantations have not xtended on to the flats of the Galatea basin, but become the dominant eature on the western rim where the state forest of the Kaingaroa lains stretches in an almost unbroken mass, interrupted only by the rebreaks and forest roads and by the main Rotorua highway as it imbs up to the plateau. To the northwest the Ngatamawahine Stream nd the forest lookout indicate the northern boundary of the exotic

g. 7. The Rotorua-Wairoa Highway on the Murupara Block. The dry, dusty landscape and the pmost terrace edge are characteristic of this part of the Galatea basin.

conifer plantations, beyond which supervenes manuka scrub interspersed with scattered pines, whilst in the south the forest of the plateau and the scrub of the eastern ranges abut in the valley of the Rangitaiki. The manuka of the eastern spurs is notable for its irregular boundary, especially in the north, for in the southeast it has been pushed back with greater persistency; but generally speaking, its lower edge is found at the break of slope.

Land Use Regions

The present landscape of the Galatea basin therefore evinces in its cultural patterns the various stages of development within the region and how far cultural diversity has been imposed on physical unity. This diversity will, in time, give way to a remarkable specialisation in the farm economy, but meanwhile it is possible to delimit within the basin and its borderlands five major land use regions on the basis of differences in the land utilisation, in the size of holdings, in the methods of farm management and in the system of tenure (*Fig.* 12).

The Station Pastures

The original station pastures north of the Whirinaki have steadily decreased in area as the Galatea scheme progressed and more land was given over to intensive dairying. The farm economy of the station, now operated by the government, has therefore been characterised by a gradual reduction in the number of stock carried, by an extensive programme of land reclamation and by a reduction of overhead costs. The most significant feature, however, is the large-scale raising of sheep and store cattle on pastures of varying quality. The depleted tussock association has been replaced by ryegrass and white clover in many areas, especially in that strip of country adjacent to the old Galatea homestead along the foot of the eastern spurs. This area (IA) is quite distinct from the central and northern sections (IB) where the swampy terrain and rough pasture are at present being reclaimed.

The number of stock maintained on the station pastures as a whole has varied considerably during the last decade. When it was realised that sheep did not benefit grassland destined for dairying, increased stress was laid on store cattle, chiefly polled Aberdeen Angus. Consequently, whereas in 1935 the station stock numbered 17,500 sheep and 3,500 cattle, in 1948 there were only 6,500 sheep and the cattle had increased to 7,000. Before 1939 the yearly wool clip was over

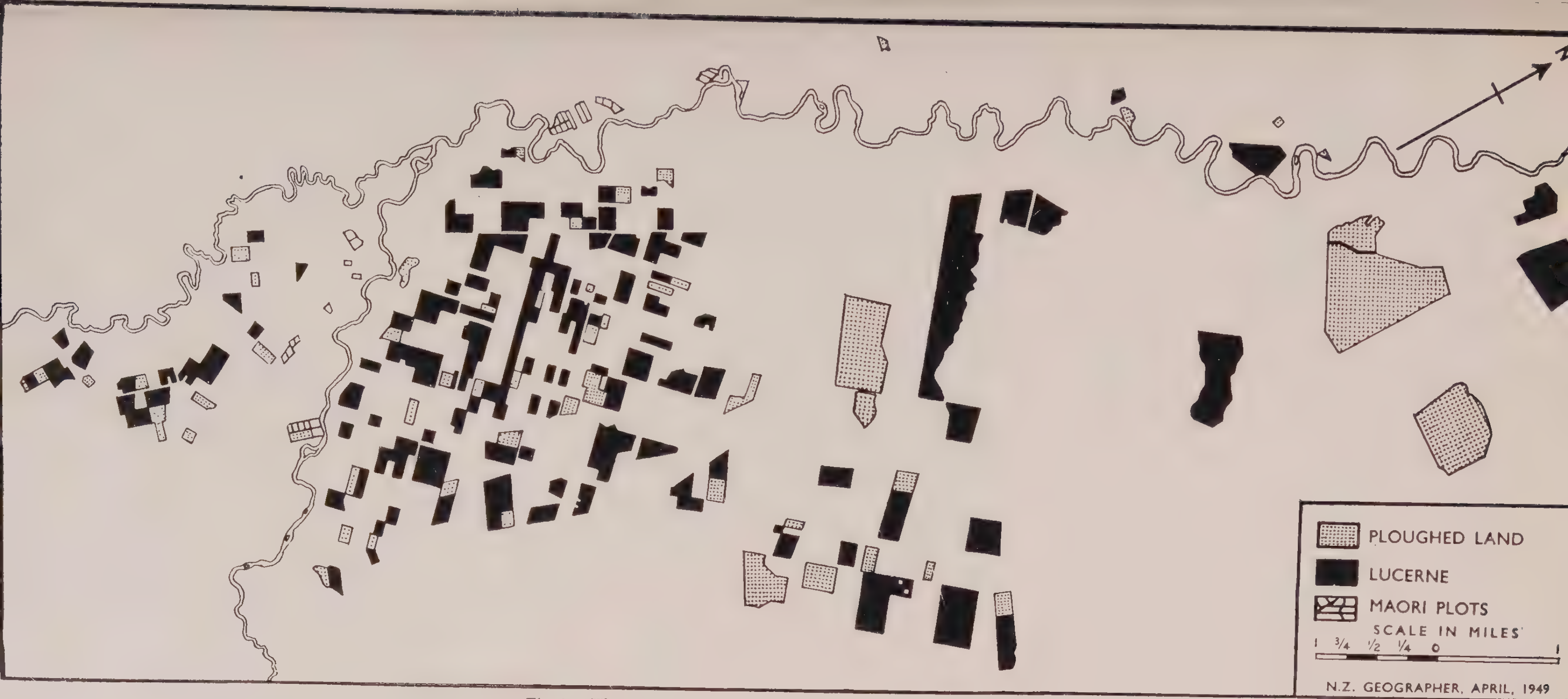


Fig. 8. The Distribution of Ploughed Land, Lucerne and Maori Plots.

four hundred bales, and eight thousand sheep made the annual three-week journey to Morrinsville. Today drovers are not to be found and the sheep must be moved out by road and rail. Another feature is the breeding of yearlings for other state farm projects, a practice which has become an important part of the economy of the Galatea station.

Winter feed for the station stock is provided by swedes and lucerne from the development areas in the centre and north of the basin. Because the size of these stands of lucerne is so great and because the labour shortage is so acute, the hay is baled, and the long rectangular stacks are typical of the station paddocks and quite different from their small round counterparts on the dairy farms.

Transitional Areas

In the central portion of subregion IB the land is being brought under cultivation as rapidly as possible. The stretches of unfenced pasture are giving way to land which has been ploughed or disced and sown with roots or lucerne, whilst at the same time scrub is being cleared and swamps drained in order to establish new pastures. These extensions are the responsibility of the Department of Public Works which has an attenuated labour force of about a dozen men and therefore utilises to the fullest extent all the machinery that is available. Trench-digging equipment has speeded up the cutting of drains in the swampy areas crossed by the Horomanga and its tributaries, and as a result of this work the water table in this part of the basin has fallen four feet. However, much of this land is heavier than elsewhere on the Galatea estate and is now scheduled for later development. Attention is concentrated on the northern part of the basin where a tract of some three thousand acres has been purchased by the government from the former station manager, who is now content to run his Herefords and his Romney crossbreds on less than a thousand acres of excellent land between the Galatea Road and the Rangitaiki north of the Kopuarahi bridge. In the new northern section the last of the old tussock pastures are disappearing under the plough, the first crops of swedes have been planted, and eventually there will follow the first sown pastures and the store cattle. Finally the dairy farms will be established on what was once marginal land fit only for large-scale ranching of sheep and horses. The central and northern zones are therefore characteristically transitional areas. They embrace vestiges of the Galatea that was; they proclaim the Galatea that is to be.

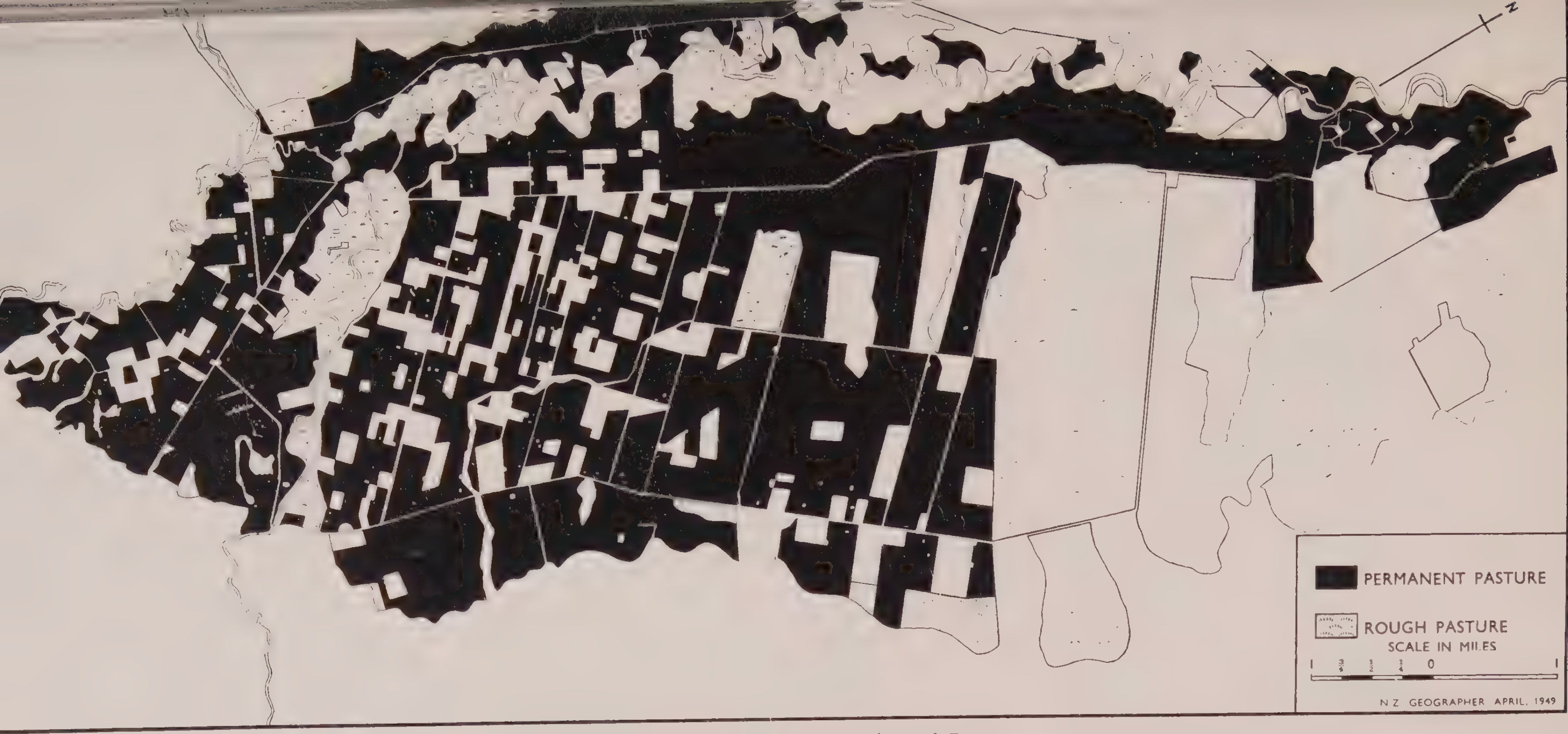


Fig. 9. The Distribution of Permanent and Rough Pasture.

The Dairying Region

The development of intensive dairying in the Galatea basin has conformed to a general pattern and has varied in only small detail in the three subregions that can be recognised. This is due essentially to the fact that governmental control and example have been forever present, and consequently similar methods of farm management have been universally adopted. It is in the size of holdings and system of tenure that the main differences lie, although the availability of water contributes a third distinguishing factor. The three subregions are the Murupara block (IIA), the Galatea estate (IIB) and the 'outliers' to the northeast (IIC).

Of these three the Galatea estate is by far the most important, the best developed and the greatest in area. Immediately to the north of the Whirinaki and protected by a deep shelterbelt that lines the edge of the topmost terrace are farms which are in the second decade of their existence. They are almost regularly spaced along the Whirinaki Road and along the western two-thirds of the Taranui Road, with the house just off the road and the cow-bail in the paddock behind (*Fig.* 11). It is here that small shelterbelts planted between paddocks give the landscape a more mature aspect compared with the open country to the north; it is here that the land utilisation reflects a well-established economy, for at least one third of every farm is under lucerne.

The acreage under lucerne and the size of each farm unit are probably the two major questions that have arisen during the short history of dairying on the Galatea estate. The economic depression of the thirties and a series of dry years emphasised that a hundred acres on the Galatea estate and sixty acres on the Murupara block were insufficient to maintain dairy herds large enough to yield an adequate income to the settlers. The holdings were reorganised on a basis of 140 acres each on Galatea by subdividing some of the existing farms and moving the former tenants to new properties, or by allotting an additional forty acres on recently developed land. Consequently it is not unusual to find that a farm may comprise two pieces of land separated by as much as a quarter of a mile. The object of increasing the acreage was to provide sufficient land to carry fifty dairy cows, mainly on grass, but as the area under lucerne on each farm was extended, so was raised the carrying capacity of the land. One acre of lucerne per cow is claimed by most farmers to be the basic ratio, and

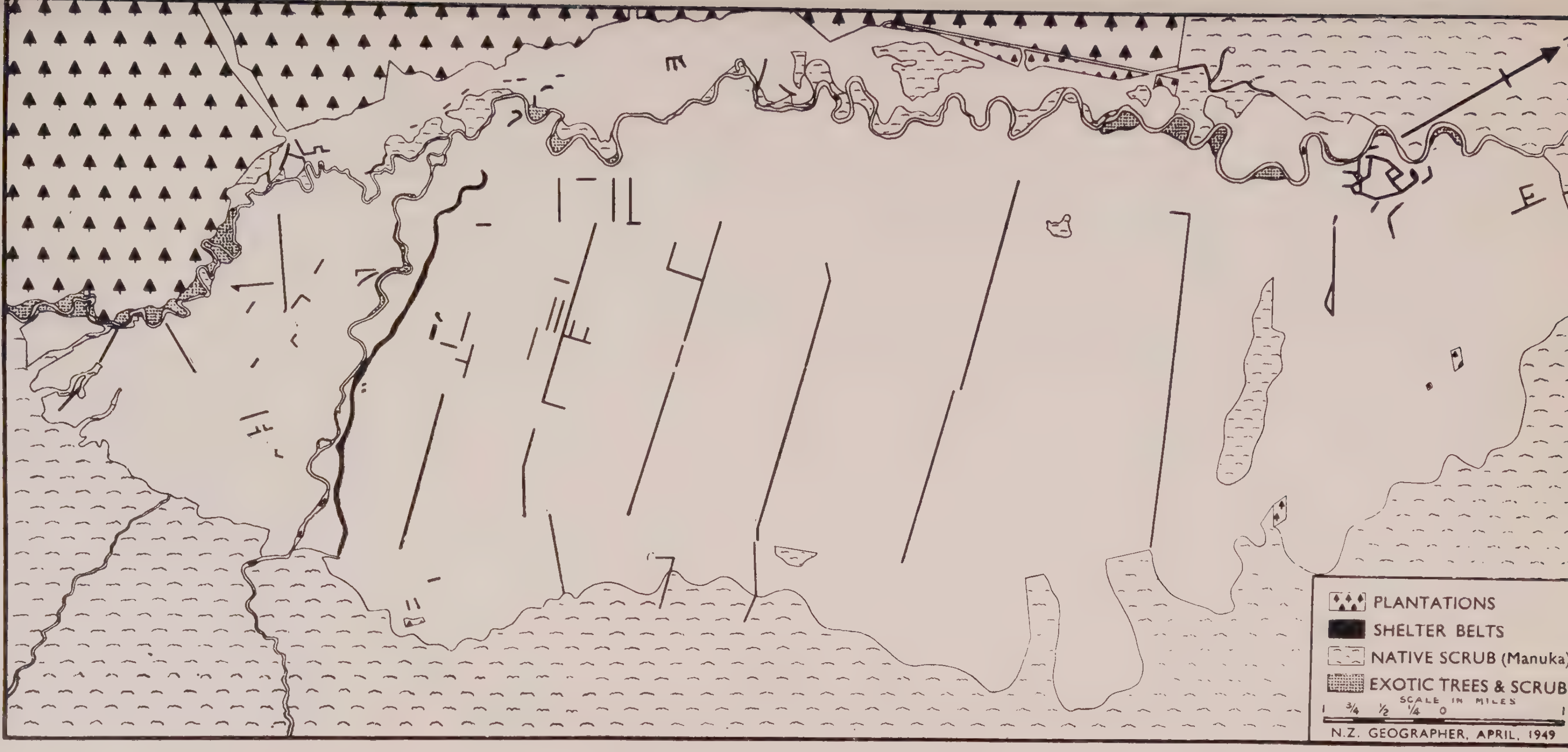


Fig. 10. The Distribution of Woodland and Scrub.

only when fifty percent of the farm is devoted to this crop will they feel themselves secure against excessive drought.

Another problem was the water supply. In this area the water table is some distance below the surface and the land dries out very rapidly, so much so that the western part is still known locally as 'the desert'. The former station manager attempted to combat this dryness by diverting a tributary of the Mangamate Stream westwards across the plain; today his four-foot trench is a gully thirty-five feet deep with a huge gravel wash sprawling beyond and overwhelming in its course the Kuhawaea, the Taranui and the Mangamate Roads. The lack of surface drainage has entailed the reticulation of water from the headwaters of this Mangamate tributary to all the farms in this southern zone. From settling tanks in the ranges there is a gravity flow to the houses and cow bails, and to the circular concrete troughs which are typical of this older section. In paddocks further north troughs are not necessary. Under normal circumstances the supply of water is adequate for all purposes, although the most westerly of the farms have occasionally to put up with a much reduced pressure. Naturally moist conditions are found only on those farms south of the Whirinaki Road which have part of their land on the river terraces. Here the summer drying-out of grassland pastures is delayed.

Figure 15 illustrates the layout of a typical farm in the older settled southern area of the Galatea estate. The original ninety-six acres were increased in 1944 by the addition of forty-two acres situated four hundred yards away on the other side of the Taranui Road. Of this total of 138 acres fifty-two are under lucerne and fourteen under roots, the remainder, approximately half, being primarily under grass and shelterbelts. Across the farm runs one of the main shelterbelts of poplar and *Pinus radiata*, now sixteen years old, and a beginning has been made with additional belts of pines and macrocarpa.

The paddocks are characteristically small on the older section of the farm, the usual subdivision being of the order of four acres. The pastures are generally a mixture of ryegrass and white clover, with paspalum and cocksfoot in certain fields, the paspalum thriving in the drier weather and protecting the other grasses, although it is immediately checked in its growth by frost. Cowgrass is not favoured since it does not produce a continuous sward—a major consideration on light soils. Some of the grassland has been down for thirteen years and is now thinning out despite regular topdressing at the rate of two hundred-

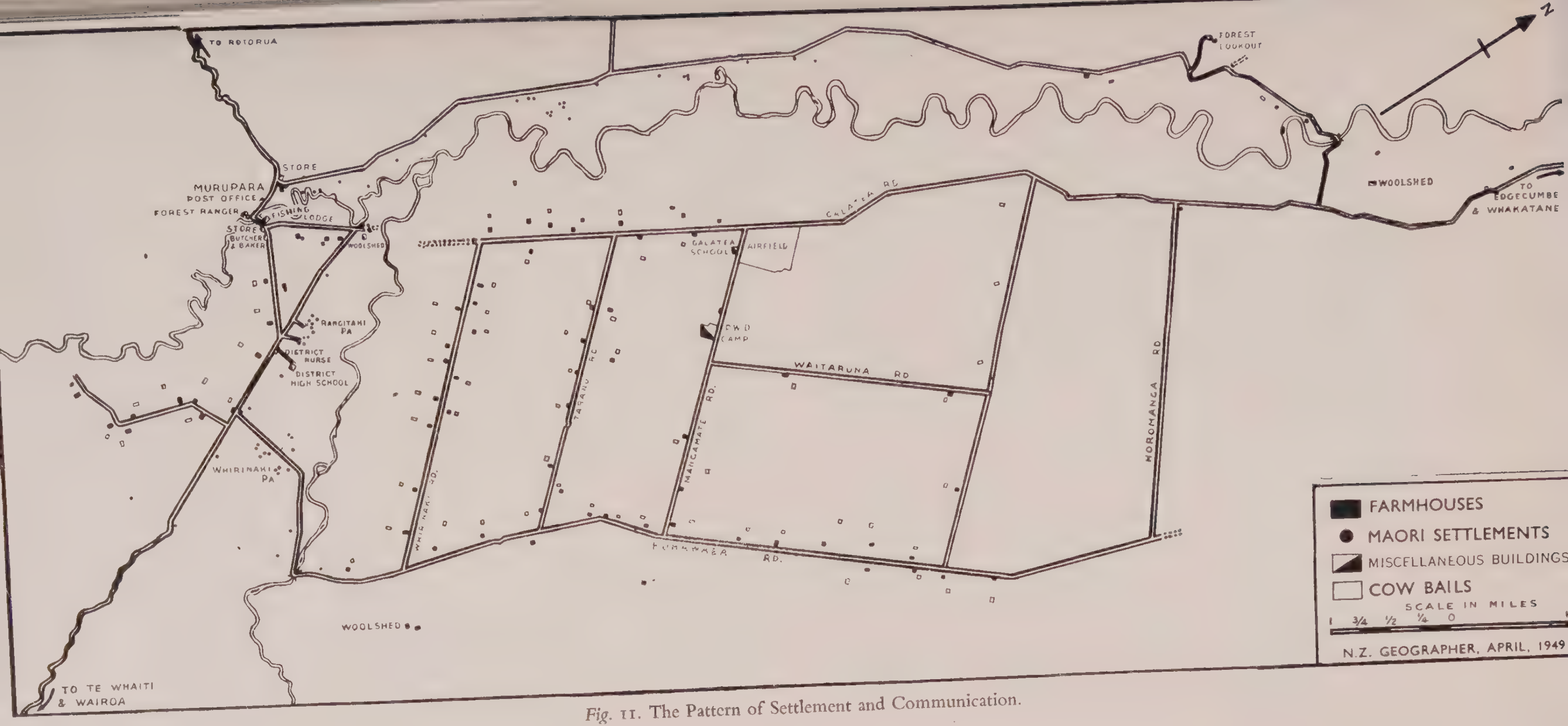


Fig. 11. The Pattern of Settlement and Communication.

weights per acre in the spring and autumn. It is ploughed up in rotation and sown with a crop of swedes before ultimately reverting to grass or lucerne. The swedes are planted in October or November and become established before the hot months, when they languish during the day and respond in the morning to the heavy dews that frequently occur. In the autumn the crop comes away quickly and develops into a useful adjunct to lucerne hay and ensilage in late winter and early spring.

Lucerne is also topdressed after cutting. Four cuts are taken on this farm each year; the first in November for ensilage, the second early in January for hay, the third late in February and the fourth in April. These last two cuts are usually fed out to the stock, but occasionally, after a good summer, the April cut is made into ensilage. This system of management does not preclude the pasturing of dairy cattle in lucerne paddocks. Some farmers adopt the practice regularly, and to this end have established lucerne in two to four acre paddocks near the cow-bails so that cows may feed before and after milking. The danger is that animals which have come off the poor summer grass will bloat if allowed to graze too long, although it has been argued by some of the settlers that if dairy cows are brought up on lucerne they will never bloat.

The distribution of lucerne exhibits no concentration of the crop on any particular part of the farm, and the sown-down periods vary from two to ten years. This is principally because the establishment of lucerne is an expensive business when the seed costs four shillings and sixpence a pound and twenty pounds are sown to the acre. The farm is typical, too, in that sixty cows are carried on fifty-two acres of lucerne and seventy of grass. The average monthly butterfat production of the herd is between 1150 and 1300 pounds, whilst the average annual return per cow ranges from 260 to 300 pounds, figures which compare favourably with those of the Bay of Plenty dairying region. Other farm stock includes two bulls, ten yearlings, five breeding sows and three horses. Forty pigs are reared on the skimmed milk and are sold as porkers, although they are essentially of secondary consideration. The use of horses is typical of the dairy farming region as a whole, for they are more economical than tractors on a farm of this size run by two men. There are two tractors on the Galatea estate, but to gain an adequate return on capital outlay their owners are compelled to hire them out to neighbours on special occasions.

The usual range of farm implements is found in the shed, the most characteristic item being the roller necessary to consolidate the very ight soils. The farm buildings in general, the fences and the gates, like hose on all Galatea farms, are in good repair and have an air of prosperity which is not too blatant. Away from the cow-bail and piggery he wooden house nestles among its fruit trees and gardens and blends with the landscape of fresh green lucerne, dusty brown grassland and sombre shelterbelt, the whole offering a marked contrast to the newer, mmature settlement beyond the Taranui Road.

The northern fringe of the intensive dairying area on the Galatea estate three miles north of the Whirinaki was occupied mainly during

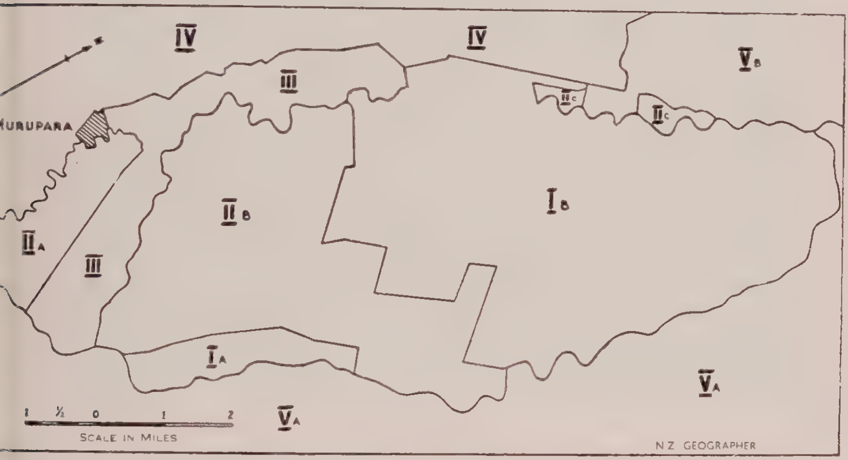


Fig. 12. Land Use Regions.

945. Along the eastern portions of the Mangamate and Haumea Roads, and especially along the Kuhawaea Road between them, new armhouses, new cow-bails and new sheds stand bleakly amid the open addocks, the major shelterbelts alone breaking the monotony of the lain. Some of the most recently established farms along the foot of he eastern spurs are not yet occupied, whilst on the western section f the Haumea Road the land still awaits subdivision. The cow-bails ave been built, but not the houses, and the lack of building materials nd fencing wire is a serious handicap in the development of the rea. (See *Fig.* 11).

However, broadly speaking, this northern fringe is comparable vith the older settled area to the south, although there are important ifferences in detail. The holdings are a little larger, approaching 75 acres in size, the paddocks are not subdivided so minutely, and there is a slightly greater proportion of grassland to lucerne; but the farm economy is essentially the same where individual farms are worked. The most obvious difference is that here there is surface water, mainly from springs and so abundant on one farm near the Kuhawaea Road that no lucerne is grown. Permanent water can be reached by shallow bores twenty-five feet in depth, and as each farm possesses its own pump no reticulation of water is necessary. Another distinguishing feature is that here are the share and wage farms operated under the control of the manager of the development scheme.

Fig. 13. A Dairy Herd on the Galatea Estate.

In order to ensure that each new farmer on the Galatea estate is fully conversant with the farming practices peculiar to the region, the government insists that he runs the farm under supervision during the first year. The farm buildings are ready, the herd of fifty Jerseys or Friesians is grazing in the paddocks, the lucerne is stacked and the swedes are in; and after a successful first year the man is allowed to continue on his own. That most make progress is seen by the fact that the average butterfat production on each farm rises steadily towards 1250 pounds per month, although there may be a slight setback later when the productive capacity of the pastures tends to fall.

The problem of the maintenance of dairy pastures is common to all the basin, but concerns particularly the lighter soils of the Murupara block and the southern portion of the Galatea estate. Experience has shown that the minimum requirement of fertiliser each year is three hundredweights to the acre, otherwise both pastures and stock languish and the steady build-up of fertility is checked. Moreover, since this increase in fertility is due in large measure to the farming and the cropping of the land, expert management is necessary, for fertiliser alone cannot put back the heart into the land, and there is in consequence a considerable variation from farm to farm in the dairy returns during the first few seasons. But the success of the first sharemilkers, who now have their own properties, and the achievements of those who have come after indicate that there is a future for dairying in the Galatea basin despite the physical handicaps.

This opinion is not confined to governmental circles, for away to he northeast two farms have been established by private enterprise nd appear as two 'outliers' on the edge of the forest and the scrub subregions IIc). Physical conditions are slightly different from those btaining on the Galatea estate for much of the land is on the terraces f the Rangitaiki and is fairly well watered. On the other hand the errain is rougher and not so easy to divide into paddocks of suitable ze, whilst weeds threaten to encroach on all sides. Yet the basic farm conomy is similar, with lucerne and swedes as supplementary feed, lthough on one holding Japanese millet is being tried as a fodder crop.

Fig. 14. Cutting Lucerne for Feeding-out.

Finally, in the far north where the road leaves the basin, an excellent airy farm is located on some of the best land in the area, fertile and vell-watered, and is again distinct because it is privately owned.

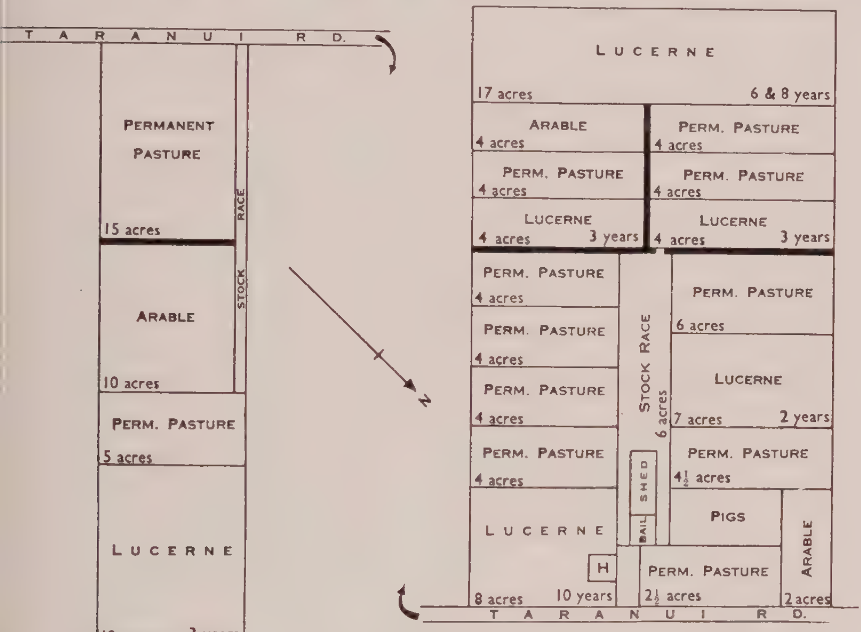
At the southern extremity of the basin is the Murupara block ubregion IIA) which is a smaller, more straggling counterpart of the alatea estate. The soil is similar and the terrain flat to gently rising, nd there is a characteristic lack of surface water except in the southeast where streams emerge from the ranges. The cultural landscape is, in general, a repetition of that north of the Whirinaki, but is, in detail, distinct in its smaller fields of irregular shape, in the less extensive shelterbelts and in an overall appearance of dusty untidiness. These features bear witness to some of the difficulties that have beset the farmers in this area.

The size of the original farm unit on the Murupara block was sixty acres, raised to eighty when it was appreciated that a dairy herd of sufficient numbers could not be carried on so small a holding. By 1940, however, eighty acres were seen to be insufficient and farms are now being reorganised on a basis of at least one hundred acres. But the size of the farm unit is not the sole problem. Water is more difficult to obtain here than in any other part of the Galatea basin, comparatively deep bores being necessary to tap an underground supply. Some of the settlers have even dug irrigation channels from the local watercourses in an attempt to improve the crops, but the soil is too porous to benefit by these efforts. Pastures, too, have suffered from drought, and in many cases are reverting to weeds and scrub, particularly on the eastern margins of the block. The wartime reduction in the supply of fertiliser has contributed in large measure also to this deterioration in carrying capacity.

It is probable that the fertility of the smaller farm unit with its decreased resources cannot be built up as readily as on the larger holdings elsewhere in the Galatea basin, and accordingly the settlers, despite every effort on their part, have not found it easy to combat a series of poor seasons. The landscape has acquired a rather neglected look in consequence, and it is perhaps significant that here is situated the holding from which comes the fresh milk supply to the nonfarming communities in the district.

The Maori Land

Along the western banks of the Whirinaki and the Rangitaiki extends a tract of country which owes its individuality to its neglect (region III). Well-watered riverland with fertile alluvial soils has been given over to scrub and to rough pasture, whilst such permanent pasture as does exist is rapidly going back as the better grasses are crowded out. The cultivated patches near the settlements alone indicate some attempt to make intensive use of the land, but even these plots of potatoes and maize are poorly tended. The Maori have no desire to develop their land. They prefer the casual labour offered by seasonal work in the state forest plantations and a type of farming that is concerned only with the running of sheep and store cattle on open pasture. Dairy farming could be established on this Maori land, for the development further to the north of the two farms owned by pakeha has been on similar terrain, and moreover, two Maori do manage two small dairy herds—but these represent only two farms out of a total of twelve.



N Z GEOGRAPHER

Fig. 15. Land Utilisation on a Typical Galatea Dairy Farm. The detached portion is some four hundred yards down the road.

Settlement is haphazard also (*Fig.* 11). The two pa constitute focal centres with the church, store and meeting house, but elsewhere dwellings are scattered singly and in groups from the edge of the eastern spurs to a point four miles north of Murupara. The expanse of rank pasture hemmed in by a rising sea of gorse and manuka and dotted with unpainted dilapidated shacks is a depressing contrast to the trim andscape across the river.

The Borderlands

To the east and to the south in subregion VA manuka scrub covers he steep slopes of the hills and beyond the fronting spurs gives way to he bush-clad ranges of the Urewera country, whilst to the north the scrub merges into the areas of exotic conifers (subregion Vb). This scrub-covered country is not important in the economy of the Galatea basin except in that it marks the limit of the basin and serves as a source of water. The state forest plantations (region IV) constitute a well-defined boundary, too, but are associated with the life of the basin in that many of the Maori choose to work as foresters. The actual number employed at present is small, but with the exploitation of the forest in the near future this borderland will assume, *vis-à-vis* the basin itself, a significance which will not be confined solely to the Maori and the two forest rangers.

Settlement and Communications

If any general characteristic is to be attributed to the settlement in the Galatea basin it is that it is individual and dispersed. In the dairying regions this dispersal adopts a regular pattern closely related to the roads; on the Maori land it is intermittent, but coalesces in the neighbourhood of the pa; and in the northeastern part of the basin it consists of scattered isolated farmhouses. (See *Fig.* 11.) Settlement is concentrated only at Murupara where there is a convergence of roads and where the Rotorua-Wairoa highway crosses the Rangitaiki before skirting the basin south of the Whirinaki. With its post office, its two stores and the premises occupied by the butcher and the baker, Murupara functions as a small commercial centre, but is relatively detached from the dairying regions. The detour via the Bailey bridge over the Whirinaki is necessary since that is the only place at which the river can be bridged easily. A bridge where the ford is at present located would solve some of the problems of access to the main dairying region of the Galatea estate, but the cost does not warrant such construction under existing conditions. The ford itself is useless except to those on horseback. Therefore until the proposed pulp mill is built some two miles to the north, Murupara will exist as a small centre serving essentially local needs, will remain as the headquarters of the forest rangers on the eastern edge of the Kaingaroa plantations, and by virtue of the fishing lodge will satisfy the wants of fishermen who wish to ply their rods in the upper courses of the two rivers.

The necessity for a centre on the Galatea estate has been recognised since the inception of the settlement scheme, for all plans and maps show the location of a 'town' of Galatea at the junction of the Galatea and the Mangamate Roads. At the moment only the school exists, with the 'aerodrome' across the way. Yet as more farms are established n the central and northern portions of the basin the centre of gravity f the population on the estate will shift further north until eventually ne distance to the post office and the stores at Murupara will be nconveniently great. The construction of a township is claimed by nost dairy farmers to be essential to the wellbeing of the community n the Galatea estate, and it is certain that, with the organisation of all ecessary public services in such a centre, the area north of the Whirinaki vill to a great extent sever its connections with Murupara and Rotorua.

At present the basin has two outlets. To the north by road goes the ream to the butter factory at Edgecumbe thirty-three miles away, ne truck covering eighty miles a day in its round trip. To the west Rotorua run the regular service cars. Thus for its shopping and ecreational facilities the Galatea basin looks towards Rotorua, but conomically is turned towards Edgecumbe and Whakatane. However f recent years there has been a tendency for the wives of dairy farmers o shop in Whakatane despite the longer journey involved, for Whaka- ne, a regional centre on the Bay of Plenty coastlands, caters more pecially for the needs of the farmer and his family. It is open to njecture how much more the basin will look towards the north when he proposed pulp mill and railway are completed, for the route rough Rotorua will always offer the quickest means of access to the st of the North Island. Moreover, by that time the basin will have hieved a certain independence. Intensive dairying will then charac- rise most of the region, and not only will the number of herds have creased from the present total of sixty-six, but also, given successful anagement, the annual butterfat production per herd of fifty cows ill have risen from the present average of 12,500 pounds towards the 5,000 pounds which is today the aim of every dairy farmer in the asin. A butterfat output of this order will justify the construction a dairy factory in the region. In addition, the expansion of dairying d the exploitation of the forest resources will make worthwhile the ticulation of electric power, the lack of which today is one of the ajor obstacles in the development of the region.

Yet much has to be done before the Galatea basin can aspire to a gnificant place in the agricultural and industrial economies of the orth Island. New marginal land must be brought under cultivation quickly as possible; old land must be maintained or improved in rtility and productive capacity; further research must be undertaken on the best methods of sowing and utilising lucerne; a better use must be made of the Maori land; and, above all, intelligent planning should indicate the lines along which the whole region is to develop. In New Zealand today the greatest need is the closer settlement of farmland as one means of supporting a larger population and of arresting the drift to the towns, and if the development of once-marginal areas like the Galatea basin succeeds in achieving these objects, even in part, the vast expenditure of wealth and energy will not have been in vain.

THE COROMANDEL PENINSULA AND THE THAMES VALLEY

MURRAY McCASKILL

THE AUCKLAND Provincial District, occupying one quarter of New Zealand and supporting one third of the population, offers some challenging problems in landscape interpretation. Although average relief is lower and climatic contrasts are less strongly marked than in other parts of the country, human occupation of a varied terrain has created that remarkable diversity of landscape within short distances which distinguishes New Zealand in general. An attempt is made here to outline the successive stages of settlement in the Coromandel Peninsula and the Thames Valley lowland, two regions which in several ways epitomise the geography of the province as a whole.

The Coromandel Peninsula region as here defined includes both a peninsular and mainland area of hill country extending from Cape Colville eighty miles south to Te Aroha where it merges without structural break into the Kaimai Range. The Thames Valley[1] is an adjacent area of flat and undulating lowland eight to sixteen miles broad and extending sixty miles inland from the Firth of Thames to the margins of the central volcanic plateau.

The two regions form an abrupt and striking geographic contrast. Physical contrasts in geology, climate, soils and vegetation have been sharpened during the course of human settlement. The peninsula has had a chequered history of exhaustive resource utilisation, a robber economy of exploitation for timber, gold and kauri gum. It was one of the earliest developed regions of New Zealand and played an mportant part in the country's economy last century. The Thames Valley is young, both geologically and culturally, and has become an mportant producer of wealth only within the last forty years. The egion has undergone a patient, scientific and constructive development, its present wealth being founded upon exotic pasture grasses nd the dairy cow. In contemporary land use and farm economies, n town forms and functions, in settlement and communication patterns, nd in the tempo of economic activity, peninsula and valley are clearly ontrasted. The peninsula is characterised by retrogression and decline.

Alternatively referred to as the Hauraki Lowland or the Thames-Piako Plain, although Thames Valley is the only name in popular use within the region.

Impressed upon its landscape are remnants of a hectic and colourful past that is unlikely to return. The Thames Valley, on the other hand, is youthful, prosperous and progressive, giving promise that the best is yet to be. At successive periods both regions have formed vital parts of the hinterland which has nourished the city of Auckland; together they are symbolic of the growth and the functions of that city, past and present.

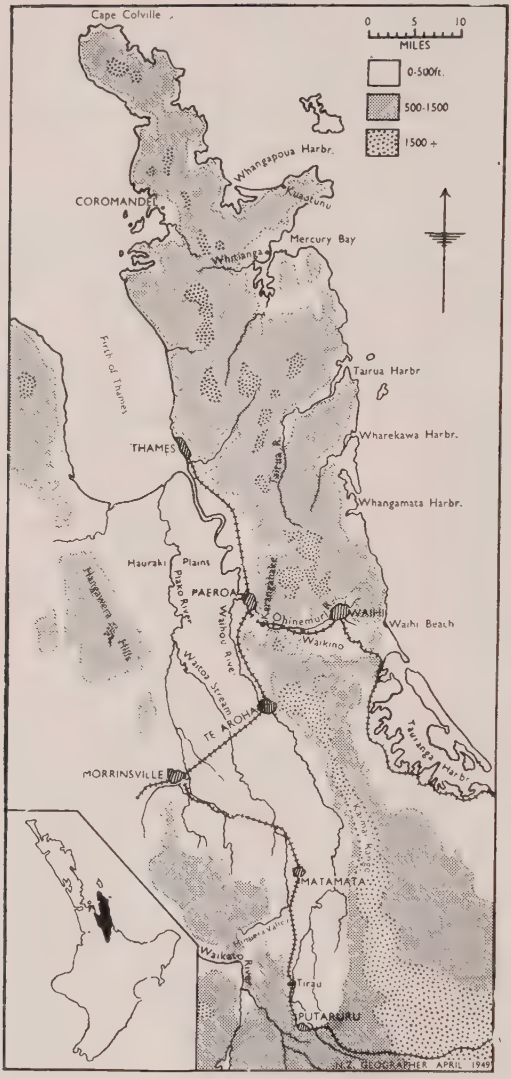


Fig. 1. Location Map.

Structure and Terrain

The Coromandel Peninsula and the Thames Valley are two long narrow crust blocks which owe their major outline to the differential earth movements of late Tertiary times. The peninsula is a deeply dissected volcanic upland comprising the Cape Colville Range and its subsidiary ridges. The region is bounded and transected by a complex system of faults, one of which forms the prominent landscape feature sharply dividing the peninsula from the valley. To the west lies the Hauraki depression, an elongated trough occupied by the sea in the north and filled in its southern portion with the accumulation of alluvial and marine sediments that forms the Thames Valley lowland. Basically, the regional contrasts are conditioned by this abrupt structural division.

The peninsula has within a small area a considerable variety of rock types. Trias-Jura greywackes and argillites form the basement rocks upon which has been extruded a vast pile of volcanic material. Early Tertiary sandstones, shales and limestones also occur, but like the older sedimentaries, they are exposed only in scattered patches in the north. On the surface, volcanic rocks dating from mid-Tertiary to Pliocene are by far the most extensive. The older volcanic rocks, chiefly andesites and dacites, were in places altered by intense hydrothermal action to form the gold-silver lodes that have played such an important part in the cultural history of the region. Since the last period of volcanic activity ceased, vigorous stream erosion in an area of abundant and intense rainfall has deeply carved the upland mass. Bayheads and inlets have been silted up, and a succession of alluvial fans, built out from the western flank of the ranges, has begun to blur the sharp tectonic outline.

Despite the relatively low elevation, deep dissection has given the peninsula a rugged and mountainous character, the land surface being a tangle of peaks, plateau remnants and ridges cut by a fine and intricate pattern of streams. Main ridges average 1500 feet in height with numerous points over 2000 feet. The highest elevations are Mt. Moehau (2935 feet) and Mt. Te Aroha which rises steeply along the western fault scarp from sea level to 3126 feet in less than a mile and a half. Lowlands are of limited extent and occur as narrow tongues bordering the lower courses of streams or as bayhead floodplains fringed with tidal mudflats. The largest area of gentle relief is the broad valley of the upper Ohinemuri River, generally termed the Waihi Plains, a high level undulating basin of about thirty square miles. Much of the scenic attraction of the peninsula is due to the indented and island-studded coastline. Bold headlands with offshore stacks, deep sheltered bays, sandy beaches and cliffed spur ends present seascapes of fascinating variety.

In contrast to the diversified relief of the peninsula, surface features in the Thames Valley are comparatively uniform. With approximately 650 square miles below the 300 foot contour the Thames Valley is the largest single area of flat land in the North Island. Its geological foundations were laid in Pleistocene times when the Waikato River, loaded with the products of rhyolitic eruptions in the central volcanic plateau, deposited a vast accumulation of fine sands and gravels in the Hauraki depression. Subsequently the sea invaded much of the valley, and estuarine muds and clays were interbedded with the water-borne debris. Since the Waikato River left the valley the older sediments have been dissected into low rolling hills preserved today on the southern and western margins, and the modern streams have built out a delta into the Firth of Thames. On the plain itself there occur low isolated ridges, remnants of an old higher level floodplain. Sluggish meandering streams, the Waihou, Piako and Waitoa, are slightly entrenched in the southern part of the valley but in the north have built up narrow levees. Bordering the valley on the west are the Hangawera-Pakaroa Hills, a discontinuous line of subdued greywacke ridges fringed with pumice-coated 'downland'.

Climate

Although the climates of both regions may be described in general terms as humid and equable with abundant sunshine, the barrier of the Cape Colville Range makes for significant contrasts in rainfall distribution. The Coromandel Peninsula is distinguished by higher precipitation totals and by their greater variability, by a more clearly marked rainfall maximum in winter and by the greater intensity of individual falls. Precipitation varies from fifty inches along the western margin to more than eighty-five inches on the Waihi Plains. Humidity is generally high, and near the summits of the ranges the profusion of filmy ferns, lichens and mosses suggests almost continually saturated air conditions.

The peninsula receives much of its rainfall from the northeasterly gales associated with vigorous wave depressions that originate near Lord Howe Island and with occasional tropical cyclones that approach North Cape in the summer. The erratic occurrence of the latter leads to rainfall variabilities of over sixty percent in the summer months. Downpours of phenomenal intensity, due to the piling of saturated air against steep slopes, are perhaps the most notable climatic feature. Falls of more than six inches in twenty-four hours are not uncommon and flash floods of destructive violence periodically sweep the lowland valleys.[2]

Rainfall totals in the Thames Valley are among the lowest in the Auckland Province; most of the region receives less than forty-five inches, and high intensity falls are rare. Temperature conditions become more extreme inland but severe frosts are unusual, the winters are short and comparatively mild, while summer temperatures are among the highest in the North Island. Anticyclonic weather in summer is frequently enervating, humidity being high and the air stagnant, for the inflow of tempering sea breezes is restricted by the mountain range to the east.

---

[2] In a storm on 29 March 1910, fourteen inches of rain fell in sixteen hours; the Ohinemuri River rose fourteen feet higher than any previous record, flooded the township of Paeroa and swept on to fertile flats great volumes of mining tailings. See 'Report of Royal Commission on the Silting of the Waihou and Ohinemuri Rivers', *Appendices to Journals, House of Representatives*, (C-14), Wellington, 1910.

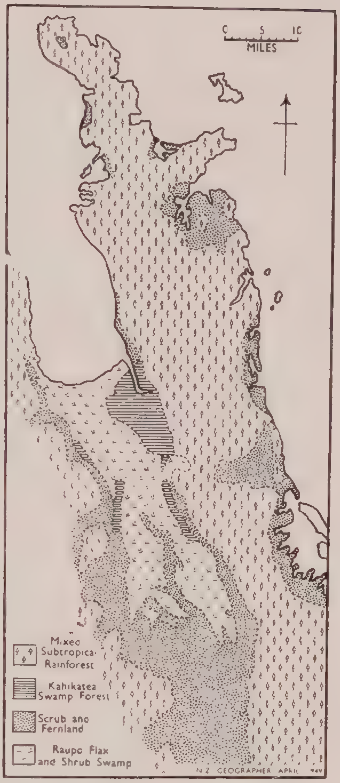

0 5 10
MILES
Mixed Subtropical Rainforest
Kahikatea Swamp Forest
Scrub and Fernland
Raupo Flax and Shrub Swamp
N Z GEOGRAPHER APRIL 1949

Fig 2. Pre-European Vegetation.

VEGETATION AND SOILS

It is highly probable that at one time forest covered practically the whole of the region but when the Europeans arrived, the vegetation pattern was sharply differentiated. The peninsula was clothed in a luxuriant rainforest with an irregular fringe of coastal, shrubland and fernland communities. Mangroves occupied the tidal waters and gnarled pohutukawas with their brilliant crimson blooms in summer clung to rocky cliff faces. The heavily-leached podsolic clays of the undulating hills south of Mercury Bay and the light pumice ash of the Waihi Plains carried a stunted cover of manuka and bracken fern; but by far the greater area was clad with a mixed rainforest in which the ordly kauri and the willow-green tawa were the dominant trees. Of the tall timber species, kauri has been the most significant economically. It grew most frequently on well-drained slopes near the ridge crests and was particularly extensive on the eastern watershed from Port Charles southwards to Whangamata. Above 1800 feet timber rees gave way to a thick mass of shrubs and creepers, while on the mist-shrouded dome of Mount Moehau occurred a small area of true ubalpine flora,[3] the northernmost outlier of high mountain vegetation n New Zealand.

In the Thames Valley the pre-European plant cover fell broadly nto three communities: swamp vegetation of raupo, flax and shrubs; kahikatea semi-swamp forest; and dry shrubland and fernland. In

---

. Adams: 'On the Botany of Te Moehau Mountain', *Trans. N.Z. Inst.* Vol. 21, 1888; pp. 32–41.

the areas waterlogged for the greater part of the year, the plant cover consisted of tall, close-growing raupo with a dense undergrowth of rushes. Shrub swamps of manuka and rushes with occasional cabbage trees occupied the less constantly inundated land. Projecting into the dull, grey-brown swamplands along the better drained river banks were narrow forest lanes of kahikatea, kowhai and totara, while on the estuarine muds of the lower reaches of the Waihou and Piako grew extensive swamp forests of almost pure stands of kahikatea. In the southern part of the valley swamp vegetation was confined to isolated pockets. Most of the upper portion of the plain and the bordering pumiceous hills with their well-drained soils was a broad expanse of manuka and bracken fern with scattered patches of light bush.

The marked regional variations in parent rock, relief, rainfall and natural vegetation were expressed in contrasts in soil distribution. Agricultural occupation of a differing character has profoundly altered original soil properties and has accentuated initial contrasts. The peninsula is characterised by the wide extent of skeletal soils in the rugged interior and by the fairly mature and infertile soils in areas of less intense relief. In the Thames Valley, where the parent material has been laid down in very recent geological time, soils are typically immature and over wide areas they originally had high water tables. Developed on peat, deltaic muds and pumice alluvium, they ranged from extremely acidic fibrous peats to meadow soils of high natural fertility.

THE COURSE OF SETTLEMENT

In their primitive state the regions thus afforded a sharp contrast as habitats for human settlement. The Coromandel Peninsula, although broken and precipitous and covered with a dense forest vegetation, was readily accessible by sea, and in its fish and bird life, timber trees, gold and kauri gum lay a wealth of exploitable resources. The Thames Valley in its primitive condition was difficult to cross or to penetrate, and offered little attraction to man. The lower part of the region was a vast dismal swamp, the home of myriads of ducks and eels, transformed in winter to a series of shining lagoons. Dark peat-stained streams, cluttered with snags, meandered sluggishly through a drab brown wilderness of scrub and swamp vegetation. The Thames Valley would have to await the application of advanced techniques before its natural resources of flat land, climate and soils could have human significance.

The value that men have placed on the resources of the two regions has varied from time to time with different stages of technology and with changing economic conditions. For an intelligent understanding of the regions as they exist today it is imperative that they be studied in their historical development. The progress of settlement falls broadly into four periods: the first, several centuries of primitive Maori occupation; the second, from the last decade of the eighteenth century to about 1860, a period of sporadic timber cutting on the peninsula and a brief phase of missionary endeavour in the Thames Valley; the third, from the 1860's to about 1910, the golden age of the quartz miner and sawmiller on the peninsula and of the large-scale farmer in the Thames Valley; the final period, from the early years of this century to the present day, marked by the decline of the peninsula and the growth of the dairy industry in the Thames Valley.

MAORI OCCUPANCE

To the primitive Maori engaged in subsistence agriculture and fishing the Coromandel Peninsula offered a favourable site for settlement. Fish and bird life of the coastal waters, flax from the stream banks, and berries, timber and birds from the bush-clad ranges were his chief resources. The fishing grounds of the Hauraki Gulf provided an ample supply of snapper, flounder and mullet, and along parts of the coastline were quantities of edible shellfish and rock oysters. Other foods were the kumara grown on delta flats and the bracken fern root collected from the scrublands near Mercury Bay. Population was concentrated especially along the west coast where there were sheltered fishing grounds and frequent patches of fertile alluvial soils suitable for kumara cultivation. At the time of Captain Cook's visit the native population of the peninsula was considerable, and although it was greatly reduced by tribal warfare in the next half century, there were still about 5000 people living in the region in the early 1840's.[4] An important centre of population was the fortified pa of Kauaeranga. This large village, capable of holding 2000 inhabitants, stood on high ground near the mouth of the Waihou commanding the land and water routeways into the Thames Valley.

In the Thames Valley only the drier margins were attractive for native settlement. On the low gravel ridges that rose above the swamps lived small Maori communities dependent on eels and swamp birds for

---

[4] E. Dieffenbach: *Travels in New Zealand*, Vol. I, London, 1843, p. 273.

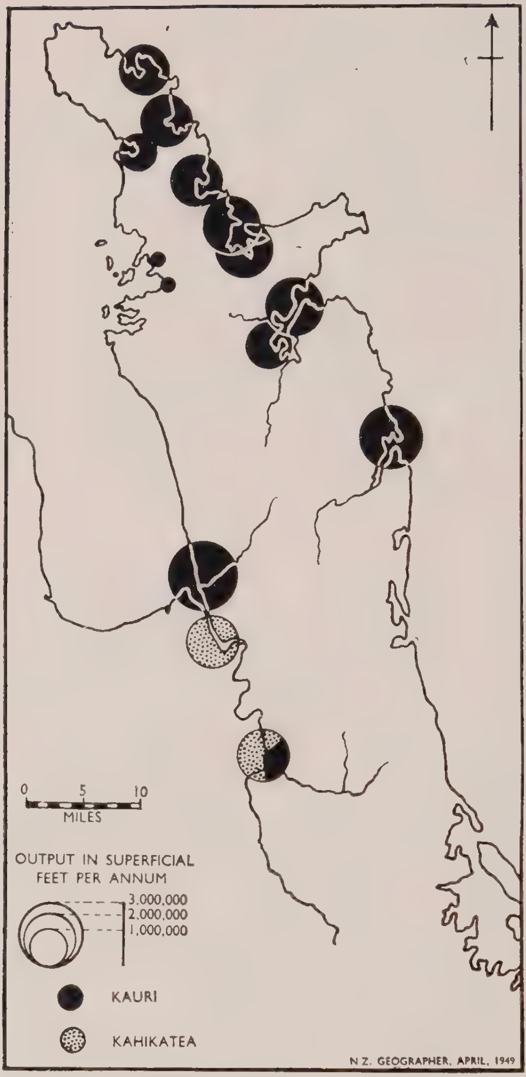

0 5 10
MILES
OUTPUT IN SUPERFICIAL FEET PER ANNUM
3,000,000
2,000,000
1,000,000
KAURI
KAHIKATEA
N.Z. GEOGRAPHER, APRIL, 1949

Fig. 3. Location and Output of Timber Mills, 1875.

food and secure in isolation from more powerful neighbours. The dry strips at the base of the hills on both sides of the valley were more thickly populated, especially the alluvial fans along the eastern bank of the Waihou between its mouth and the junction with the Ohinemuri. At Matamata on the fern-covered plains at the southern end of the valley were two large villages, home of the great fighting tribe, Ngati Haua. In general it can be said of both the Thames Valley and the Coromandel Peninsula that the Maori population was confined to coastal and riverside localities where conditions for food supply were most favourable. Today evidence of primitive Maori culture is still apparent in many parts of the peninsula where terraced hillsides clearly mark the sites of fortified pa.

The European Impact

The first European navigators to visit the northern peninsulas of New Zealand were deeply impressed by the vast forests of kauri and kahikatea. With timber from Baltic countries becoming increasingly difficult to obtain, England was looking for new sources of supply for shipbuilding. The Coromandel and North Auckland Peninsulas thus had an immediate economic significance which surpassed that of any other part of the country, and together they formed the chief focus of European enterprise in New Zealand until 1840. From 1795 onwards vessels called intermittently in the Firth of Thames and loaded kahikatea spars for the merchant fleet of the East India Company. There is no direct evidence of kauri being cut until the voyages of the *Dromedary* and *Coromandel* in 1820.[5] This marked the beginning of the widespread and determined assault on the peninsula's timber resources, and numerous Sydney traders supplied kauri spars under contract to the British navy.

For a brief period there grew up on an island in Coromandel harbour a small cosmopolitan settlement of timber traders, runaway sailors and convicts, and land speculators.[6] Of quite a different nature were the frontier outposts of the Church Missionary Society founded at Puriri in the Thames Valley in 1834 and at Matamata in the following year. The settlements were abandoned during the tribal wars a few years later, but the orchards and gardens at these stations marked the beginnings of European agriculture in the valley. In 1852 gold was discovered at Coromandel, and in a few months the field was rushed by 2000 diggers. But when it was found that the field was not an alluvial one and that lode mining with the primitive equipment then available was unprofitable, enthusiasm waned and the population dispersed. The first period of European enterprise was thus one of small-scale destructive exploitation. The landscape suffered no profound changes and settlements were small and ephemeral. By 1860 most of the accessible kauri timber of the western bays had been removed, but the vast forests of the eastern watersheds of the peninsula were virtually untouched, and the exploitation of gold had been limited to sporadic surface scratchings.

More important was the change in the Maori life and economy. Early in the nineteenth century North Auckland tribes armed with muskets almost annihilated some settlements on the peninsula. Agriculture was modified by the introduction of new sources of food in pigs, grain, potatoes and fruit trees. Cultivation of the kumara was neglected in favour of the potato, and the more diversified food supplies reduced the Maori's dependence on the natural products of the sea and forest.

R. A. A. Sherrin and J. H. Wallace: *The Early History of New Zealand*, Auckland, 1890, pp. 114-115.

. Logan Campbell: *Poenamo*, London, 1881, p. 137.

In response to technological advances and changing economic conditions, there followed in the 1860's a more ruthless, efficient and complete exploitation of the peninsula's natural resources. It began with the construction of several large sawmills and with the spectacular rush to the Thames goldfields in 1867, and was marked by a rapid and unique transformation of the landscape of the peninsula. During this period the peninsula reached the zenith of its growth, both in population and in economic importance, and at the same time contributed substantially to the growth and prosperity of the city of Auckland.

Increasing demands for timber from the rapidly growing population of Australia and New Zealand, improvements in timber-milling equipment and the application of steam power to mill machinery led to a rapid development of the kauri timber industry. Regular in the grain, free from knots and smooth of surface, kauri was unsurpassed for building purposes, while its great strength and durability made it ideal for heavy constructional work such as railway sleepers, bridges, wharves and mine props.

Timber Milling

By 1875 there were thirteen kauri timber mills operating on the Coromandel Peninsula and two mills on the banks of the Waihou River cutting the white pine forests of the lower Thames Valley.[7] These mills were then producing one third of the timber output of the Auckland Province and employed about 700 men. Logging methods were unique by New Zealand standards and have rarely been employed outside the northern peninsulas. Steep slopes, numerous streams with but a short drive to the mills, an indented coastline with sheltered anchorages, and a short haul by sea to the market and distributing centre at Auckland were natural advantages favouring cheap and simple extraction. The kauri trees, found generally in groves near ridge crests, were felled and cross-cut, then rolled to the stream beds. In the headwaters of streams were built log dams about twenty feet high and planked with pit-sawn timber. After continuous heavy rain from northeasterly gales the gates were tripped and a flood of water rushed down the stream bed driving logs to the booms at tidewater.

In three decades, from the 1870's till the end of the century, the forest resources of the peninsula were ruthlessly and energetically squandered. Timber was cheap and in the haste to get a few good logs to the mills, thousands of younger trees were destroyed and a large proportion of logs were smashed to splinters on rocks as they were swept downstream. On cut-over country, if left untouched, a vigorous second growth interspersed with young kauri rickers soon appeared; but this did not proceed unchecked.[8] To the destruction caused by the bushman were added the fires of the gold prospector and gum digger, the browsing of stock around timber camps and the ravages of wild pigs and goats in the interior. Near the west coast and the northern bays the forests were quickly exhausted, but on the Mercury Bay watershed and in the Tairua and Kauaeranga Valleys milling continued well into the twentieth century. The last extensive kauri forests were felled in the rugged country south of Waihi and Karangahake. Tramlines ran from the bush to the townships of the Ohinemuri goldfields where the kauri was in demand for mine timbering.

---

[7] *Appendices to Journals, House of Representatives* (C-3a), Wellington, 1875.

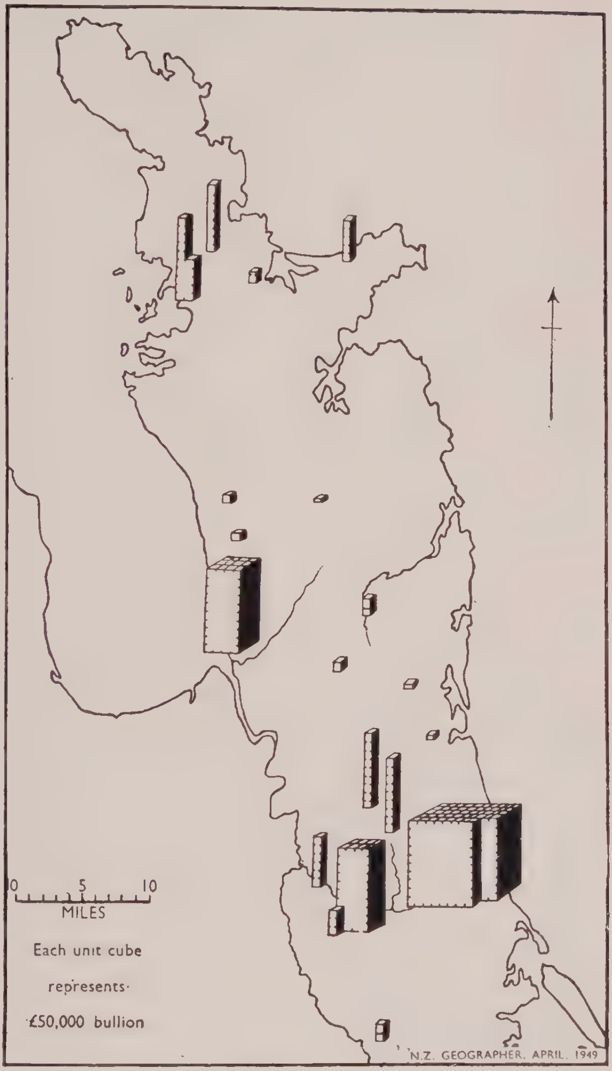


Fig. 4. Value of Gold and Silver Production up to 1945.

The Peninsula Goldfields

The large-scale mining of the peninsula's gold and silver began with the opening of the Thames goldfield in 1867. From Auckland, then stagnating in an economic depression, thousands flocked across the Hauraki Gulf to the new El Dorado. Others came from the alluvial goldfields of the South Island, the mushrooming of townships began, and rapid movements of population characterised the peninsula during the next forty years.

---

[8] 'Report of Conservator of State Forests', *Appendices to Journals, House of Representatives*, (C-3), Wellington, 1877.

Although metalliferous lodes were widely distributed, most of the bullion has come from three comparatively small areas; Coromandel, Thames and the Ohinemuri Valley. Moreover considerable intervals of time elapsed between the major gold discoveries. The resistance of Maori landowners to the encroachments of prospecting parties confined activities at first to the west coast, and the dense forest undergrowth made the search for minerals difficult. The goldfields were of the bonanza type, the metal occurring in quartz reefs in irregular shoots, often of phenomenal richness but rapidly worked out. Twisting and faulted lodes of highly variable gold content made for a chequered course of mining and a universal feature was the impoverishment of ores at lower depth. With few exceptions payable ores have been confined to within 500 feet of the land surface.

However, in many respects the goldfields of the peninsula were more favourably endowed than those of the South Island. Ready access by sea to the commercial centre of Auckland ensured cheaper and more regular supplies than in the southern fields. The rigorous winters and parching summers of Central Otago had no counterpart here, nor did the miners have to risk death by drowning as in the turbulent rivers of Westland. Although alluvial gold did not occur, the rugged relief of the peninsula generally favoured cheap lode mining by horizontal drives. In the early stages the metal could be readily extracted from bonanza ore by the simple crushing and amalgamation methods then used on the Californian and Australian goldfields.

The first concentrations of mining population were at Thames and Coromandel on the west coast. Within three years there were 12,000 people on the Thames field and in 1871 bullion yields soared to £1,000,000. The town assumed a character directly related to its function as a mining camp. The canvas tents and raupo whare of the first few months gave way to a sprawling town of hastily constructed wooden cottages with shops, offices and hotels packed tightly in the one main street. At weekends when the miners from the hills, in their gay check shirts, moleskin trousers and broad-brimmed felt hats swarmed into the town, the streets were filled with colourful and cosmopolitan crowds such as had been unknown in the North Island. The hills behind the town, stripped of their bush cover by prospecting parties, were soon scarred with surface workings and honeycombed with mine shafts and drives. Along the foreshore, and scattered within the town itself, were several dozen small quartz-crushing batteries. The thud and grinding of their stampers set up a continuous roar. Coal shipped from the North Auckland and Waikato fields supplied the motive power for the pumping and winding machinery in mines and for operating the larger batteries.[9]

Throughout New Zealand the demands set up by the gold rushes gave impetus to local manufacturing industries, and two large foundries built at Thames in 1869 and 1870 reflected this general trend. Quartz-crushing machinery was best assembled at the centre of mining operations and large-scale repair work was frequently needed. Today these foundries survive as heavy constructional and engineering works, relic features of a decayed mining economy.

LIMITED EXPERIENCE AND TECHNOLOGY

The nature and scale of the early mining operations reflected the hectic speculation and excitement that generally follow the discovery of a bonanza ore field, and indicated also the limited experience then possessed in the techniques of lode mining. Large numbers of local companies, precariously financed and each operating its own small battery, made for the persistence of obsolete and inefficient methods. Quartz was crushed in slow-moving stamper batteries and the gold saved by passing the pulp over quicksilvered copper plates; but a large proportion of the metal was swept out in tailings and slimes and was lost.[10] Slump and stagnation followed in the 1880's when the Thames and Coromandel veins became worked out at lower depths, and miners turned to gum digging and prospecting, activities which provided a mere subsistence living.

In the last decade of the century, technological changes and chance discoveries of new ore bodies rejuvenated the languishing mining ndustry and produced radical changes in the pattern of settlement. mproved crushing and extracting machinery, the fruit of experience

---

Despite the high rainfall and the character of the relief, the peninsula's resources of water power are meagre. Catchment areas of even the main streams are small and the irregular incidence of rainfall makes for wide fluctuations in stream flow. Many small batteries, in the backcountry especially, have been operated by water power but the larger plants used coal and, more recently, electricity generated on the Waikato River.

[10] C. Fraser: 'The Geology of the Thames Subdivision'. *N.Z. Geological Survey Bulletin No. 10*, 1910, pp. 11-12.

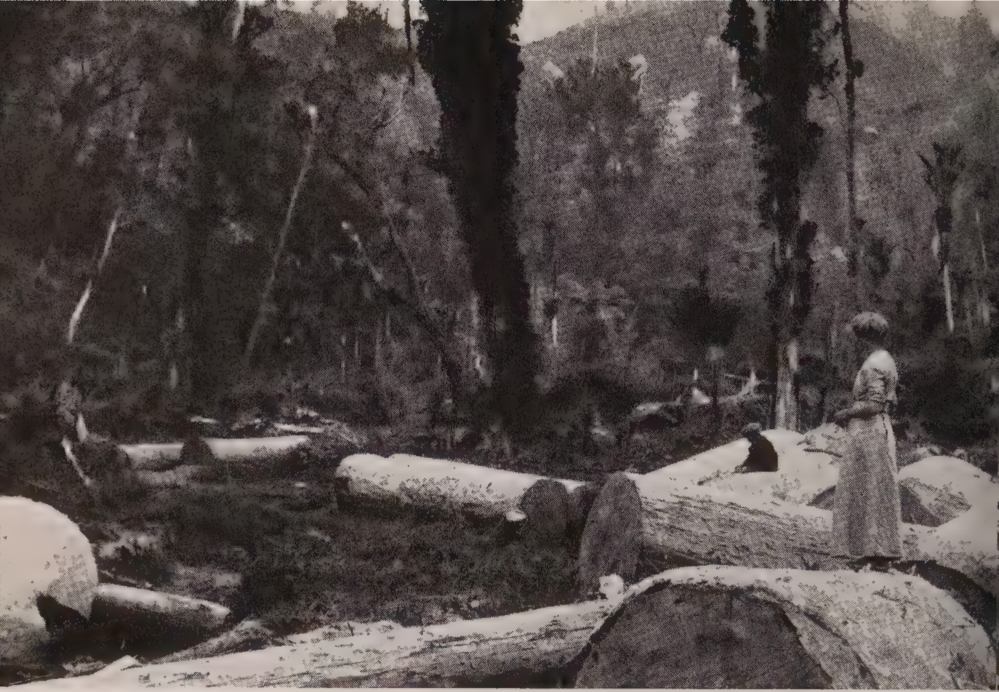


Photo: *Turnbull Library Collection*

Fig. 5. Kauri Timber Logging in the Mercury Bay Watershed.

gained in Australia and in the Rocky Mountain states of North America,[11] were introduced to the Coromandel fields. The application of the cyanide process made it possible to work the large bodies of low grade gold-silver ores in the Ohinemuri Valley. English capital largely supplanted local capital, and the unified financial control permitted thorough exploration of claims and the use of mechanised processes of extraction and reduction.

Enormous areas were pegged out in mining claims and camps grew up in isolated bays, remote interior valleys and even on mountain crests. As yields from the great Martha reef mounted steadily the desolate scrub-covered Waihi Plains became the site of New Zealand's largest and most prosperous mining town. Cottages with well-kept gardens and coniferous shelter trees were soon strung over an area of six square miles, poppet heads of mines stood out on the skyline in all directions, and the streets of the town were crossed by a network of light railways which connected the mines with the batteries.

Perhaps the most striking example of a settlement pattern directly related to extractive industry was the agglomeration of mining townships in the narrow valley where the Ohinemuri River cuts through the Cape Colville Range. Karangahake and Mackaytown at the peak

---

[11] *Handbook of New Zealand Mines*, Wellington, 1887, pp. 369-377.

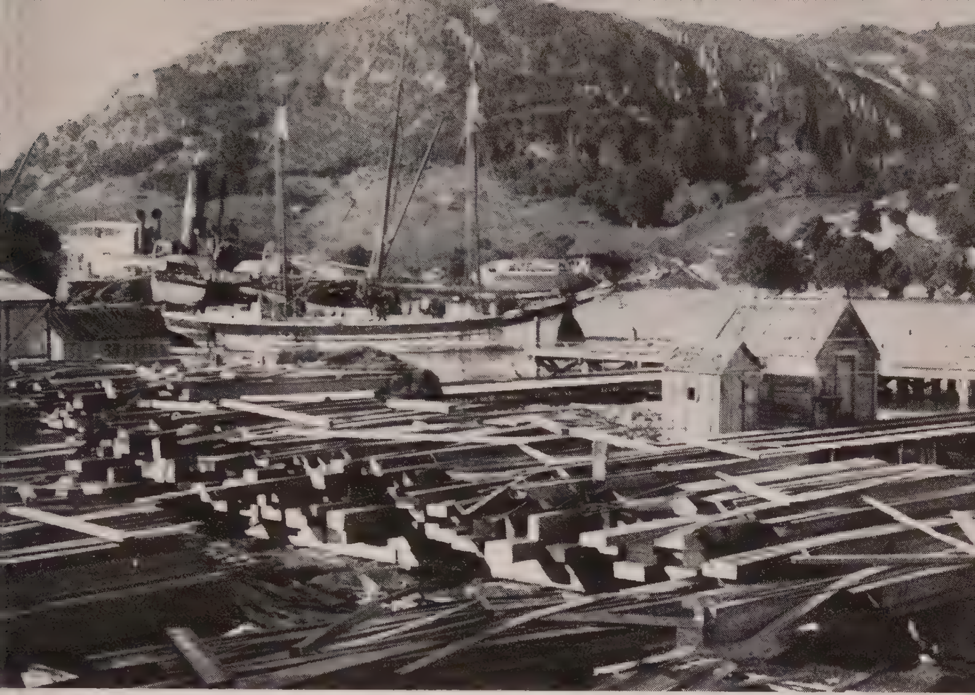


Photo: *Turnbull Library Collection*

Fig. 6. Kauri Timber Awaiting Shipment at Mercury Bay, about 1910.

of their growth were each a disorderly assemblage of shops, hotels and small cottages, with massive crushing batteries, mills and powerhouses perched on steep valley sides. The discharge of tailings turned the Ohinemuri River into a sludge channel, navigable waterways lower down became silted up, and floods swept great volumes of accumulated mine refuse on to fertile lowland farms.

Timber and gold were the mainstay of the peninsula's prosperity, but also characteristic of the period were two minor industries based on the exploitation of natural resources, gum digging and flax milling. Fossil kauri gum was dug in widespread localities, in the scrublands of the east coast and along the western slopes of the ranges from Thames to Te Aroha. The gum digger followed in the wake of the sawmiller, and to aid his search sent fires raging through cut-over forests, destroyed nuch valuable standing timber, and turned thousands of acres of regenerating bush into a wilderness of fern and manuka.

The flax which grew along the lower courses of streams in the peninsula and in the swamps of the Thames Valley attracted European raders in the first decades of the nineteenth century. When flax prices oared in the late 1880's, half a dozen mills were built along the banks of the Waihou River and others on the Piako and at bayheads on he peninsula. Flax millers, often as wasteful in their methods as the sawmillers, cut leaves regardless of length, and within a few years the best swamps were exhausted. Gum digging and flax milling were both sporadic industries, highly sensitive to market fluctuations and employing a semi-nomadic class of unskilled labour.

The Legacy of Exploitation

The exploitation of the resources of the Coromandel Peninsula in the past has left characteristic marks upon the present day landscape. Gold mining disturbed the surface cover to a lesser degree than did the milling of timber; the areas it affected were of more limited extent and from the point of view of present occupance it has been less destructive. Visible evidences of former mining enterprise are the disused shafts, adits and prospecting drives, the occasional hillside gashes marking surface workings, the heaps of battery residues partly obscured by gorse and blackberry, concrete foundations of stamper batteries, and the neglected orchards and scattered conifers that mark the sites of former settlements. More significant has been the influence of gold mining on the location and character of settlements that have survived but have long since changed their functions. Also apparent is the preservation of a mining tradition that has tended to retard the development of other activities.

Quartz mining on the Coromandel Peninsula did not leave the trail of destruction that was the aftermath of alluvial mining in Westland and Otago. In many places even the buildings have been removed elsewhere and whole townships have disappeared. The activities of the sawmiller and gum digger, however, have left more widespread marks upon the face of the land. Until recently hundreds of log dams could be found in the narrow stream beds of the interior, although most of these have now disappeared. The more permanent survivals are the logging tracks zigzagging from valley floors to crest lines, the mutilated forest edges, the hillsides pitted with gum workings now covered in stunted scrub, and the expanses of fern and second growth, with here and there a charred tree stump, the only relics of the primeval forest.

Pioneer Farming in Thames Valley

At the same time as the Coromandel Peninsula was exploited for its mineral and timber wealth, the Thames Valley underwent a slower and more subtle change. The conclusion of the Maori Wars in 1872 and legislation conferring individual title to native lands removed some of the barriers that had long held up the expansion of farming in the North Island. In the Thames Valley the demand for food products in the mining townships of the peninsula was an added stimulus to agriculture. During the last three decades of the century the frontier of white settlement was pushed forward and the way prepared for the growth of the dairy industry.

By 1880 most of the open country in the Thames Valley, except the deep peat swamps towards the sea, had been taken up in huge freehold estates. This was some sixty years after the first export of kauri and the onset of widespread exploitation on the Coromandel Peninsula. Within a few years the dull, fern-covered plains and downlands had become a chequerboard of large blocks of crop and pasture. Long rows of gums and conifers provided shelter for stock and relieved the monotony of the open treeless landscape. At distant intervals, and marked by clumps of English trees, were the estate homesteads with their compact clusters of cottages, stables, barns, repair shops, woolsheds and yards.

To bring in grass seed, fencing material and farm machinery, and to create an effective outlet for their produce, estate owners cleared the snag-blocked reaches of the Waihou and Piako Rivers, dredged hallows, blasted away rapids with dynamite and ran their own steamer services to Auckland. The farm economy was a mixed one of beef cattle and sheep rearing on temporary pastures, root and forage cropping, and grain growing. Farm methods were extensive. As many as 50,000 acres were operated as a single unit and paddocks of more than a thousand acres were common. The labour force was small but farm operations were, for that period, highly mechanised. Each estate had its complement of reapers and binders, mowing machines, threshing mills, mechanical hay loaders and traction engines. Livestock products, wool, fat sheep and cattle were the principal sources of ncome. Hereford and Shorthorn cattle fattened on root crops and clover pastures were driven overland to the markets at Thames and Auckland. The sheep reared were mainly the heavy-framed Lincolns, English Leicesters and Shropshire Downs, but merino and halfbred store sheep were driven over for fattening from Napier and the east coast of the North Island.[12]

Dry land was readily broken in by burning off scrub and fern and was surface-sown with clovers and English grasses.[13] However, the

---

Stock sale advertisements in *Te Aroha News*, 1889.

G. W. Wild: in *Te Aroha and the Fortunate Valley*, Te Aroha, 1930, p. 54.

thin veneer of fertility in the light pumice soils was quickly exhausted, and to prevent reversion to fern and native grasses, pastures had to be ploughed within two or three years, cropped and resown. Oats for the large number of draught horses and station hacks, clover hay, and swedes and rape for livestock fattening were the chief crops. The farm economy was similar in methods and scale to the extensive mixed farming then typical of Canterbury and Otago, but differed in the higher proportion of cattle to sheep carried and in the restricted development of grain cropping.

Some estates were established on the swamplands north of Morrinsville. Homesteads were built on ridges, and the patches of dry land cropped for winter feed. In summer the cattle were turned out to graze on weeds and natural grasses in the neighbouring swamps. Much effort was spent in swamp drainage schemes but because of the lack of effective outlets and of adequate topdressing of pastures the swamps became sinks for money. The peaty topsoils were deficient in lime and phosphate and pastures rapidly reverted to Yorkshire fog, rushes and manuka.

When mining operations were extended to the Ohinemuri goldfields small-scale farmers began to settle in the valley. Southwards from Thames a narrow fringe of agricultural settlement advanced along the dry strip formed by coalescing alluvial fans at the base of the Cape Colville Range. As on the estates, mixed farming predominated—sheep and cattle rearing and the growing of oats and potatoes, with dairying and fruit growing as sidelines. South of Te Aroha a group of forty families of English immigrants attempted with much patient toil but with little success to develop a block of heavy swampland. Until the turn of the century the growth of a prosperous and stable agriculture in the Thames Valley was hampered by two major difficulties; first, swamp drainage, and secondly, the establishment of good quality permanent pastures on both dry land and swamp. Until these problems were solved estate owner and small farmer alike suffered many years of bitter failure and wasted effort.

Clumps of English trees marking old homestead sites, and plantations of gums on dry knolls are the few visible survivals of the period of extensive farming. However, the lessons learned were not without value to the dairy farmers who followed. The high tide of large-scale agriculture was reached in the 1890's when most of the estates, heavily burdened with debt, were taken over and administered by a government agency. Under capable and scientific management it was shown that topdressing of pastures with artificial fertilisers such as basic slag, guano and bonedust would prolong growth and maintain quality. Moreover it was shown that by careful breeding and adequate feeding the region could produce export lambs of a quality comparable with that of the South Island.[14] Indeed the Thames Valley and the Waikato were the cradle in which were developed many of the basic practices of grassland farming that have now spread throughout the North Island.[15]

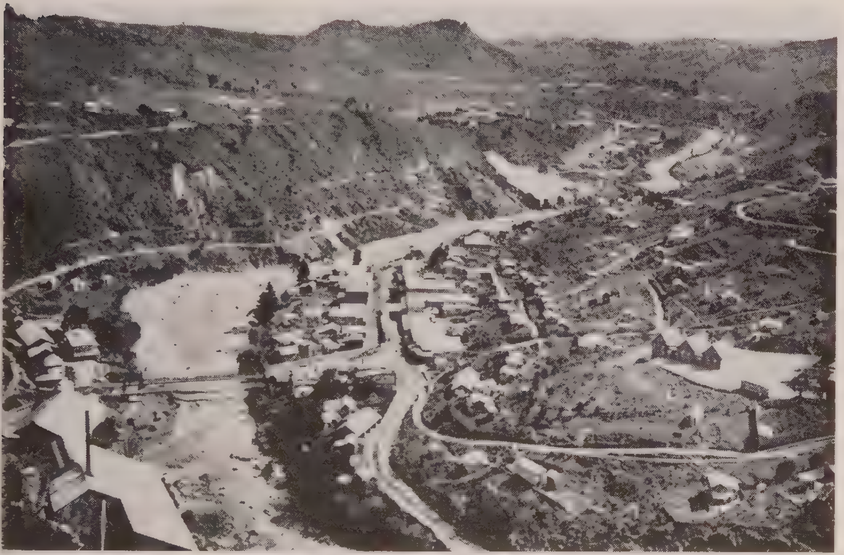


Photo: N.Z. Department of Mines.

Fig. 7. Karangahake during the mining boom of the first decade of the 20th century.

Communications

In both the Coromandel Peninsula and the Thames Valley serious physical obstacles hampered the development of land communications. During the nineteenth century water transport played an important part in the economy of both regions and was reflected in the pattern of settlement. The extremely rugged relief of the peninsula militated against road building, and communications between mining camps were restricted to graded tracks, many of them fit only for saddle-horse traffic. However, peninsular location and proximity to Auckland favoured the growth of sea transport both to the goldfield centres of the west coast and to the sawmilling settlements on the east.

In the Thames Valley the major obstacles were the soft peat swamps and the lack of suitable road-building materials. The Waihou River was the main routeway at first and small paddle steamers and barges the chief means of transport. A few roads skirted the hill country or followed stock routes on firmer ground near river banks, but in wet weather even these became impassable quagmires. As long as waterways were the only means of communication, agricultural settlement was confined to narrow ribbons along stream banks. The shortcomings of existing means of transport became even more evident when the Ohinemuri goldfields were opened. Mining machinery and coal had to be taken up the Waihou by steamer, discharged at Paeroa, and then drawn to the mines by horse teams. Moreover the stranding of vessels on sandbanks and the uncertain river flow in summer made this service unreliable.

---

[14] F. Carr Rollett: in *Te Aroha and the Fortunate Valley*, *op. cit.*, p. 236.

[15] Certain aspects of this topic are treated more fully in J. M. Miller: 'Topdressing', *N.Z. Journal of Agriculture*, Vol. 75, No. 1, 1947, pp. 19-32.

In 1880 construction was begun on a railway to link the coal mines and farmlands of the Waikato with the Thames goldfields. Six years later the line had crossed the lower end of the swamp between Morrinsville and Te Aroha but did not reach Thames until 1898. At the same time a railway was slowly pushed southwards in the upper Thames Valley to serve the tourist traffic in the Rotorua district. Railway construction in the Thames Valley thus preceded the growth of intensive farm settlement and was a response to factors external to the region itself.

THE PATTERN OF SETTLEMENT

The map of population distribution in 1901 forms a convenient summary of the human geography of the two regions at the turn of the century. By that date the economic activities and settlement patterns which characterised the previous forty years had been fully developed. The Coromandel Peninsula had three times the population of the Thames Valley. Of its white population of 18,500 half was located in the towns of Waihi and Thames, and another quarter in smaller mining townships and villages. In marked contrast to the alluvial goldfields of the South Island there was no Chinese element among the population. Population distribution was irregular, for the most part concentrated where mineral lodes were being worked or near the sawmills where streams from the forest-clad hills joined the sea. A notable feature of the period was the blurring of the predominantly peripheral pattern of settlement by the small communities of bushmen, miners and gum diggers on high mountain crests and interior valleys which are today uninhabited. Regrouping of population quickly followed the exhaustion of resources in some localities and the discovery of new ore bodies in others. An outstanding feature of the map is the concentration of population in the mining settlements of the Ohinemuri Valley. Here the low grade gold-silver ores were of little human significance while metallurgical processes were inadequate, but with the introduction of the cyanide process there was a rapid inflow of population, to be followed by an equally abrupt decline when payable ores were worked out.

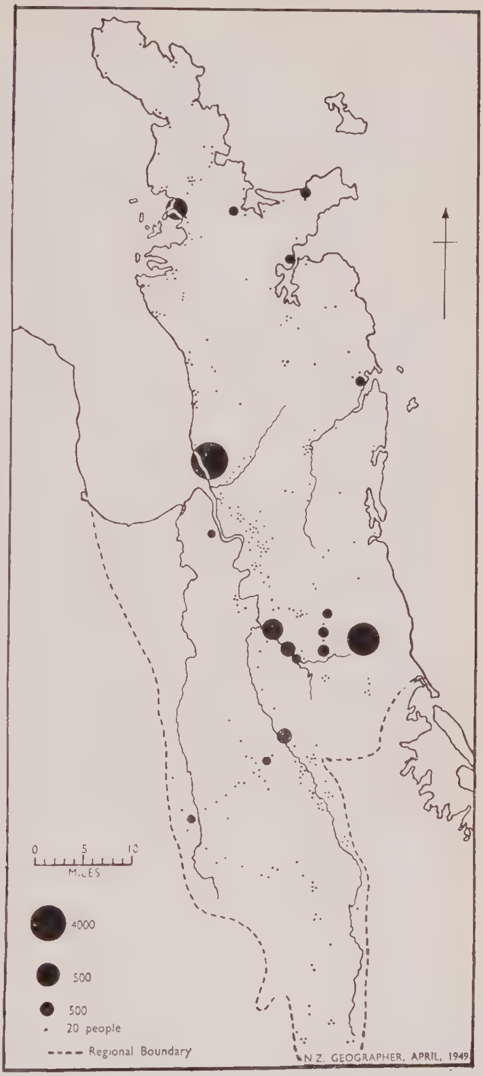


Fig. 8. Population Distribution, 1901.

Settlement in the Thames Valley was localised in narrow strips along the main arteries of travel, the railways and the Waihou River. At the base of the hills between Thames and Paeroa agricultural settlement was by 1901 fairly intensive and Paeroa had already grown to a substantial township as a distributing centre for the Ohinemuri goldfields. Te Aroha, mushroom growth of a gold rush in 1880, survived by virtue of the tourist traffic attracted to mineral springs at the base of the mountain. In the southern part of the valley there were three main ribbons of agricultural settlement. Groups of small farmers south of Te Aroha had penetrated the valley up the Waihou River and two lines of settlement closely following the railways had spread eastwards from the Waikato through the Morrinsville gap.

The Dairy Industry

The fourth distinctive period of settlement began with the growth of the dairy industry in the Thames Valley during the first decade of the twentieth century. There was a fairly rapid change in the relative importance and prosperity of the Coromandel Peninsula and the Thames Valley. Gold production declined after 1910 and the final assault on the timber resources of the peninsula was made during the 1914-1918 war. Landmarks in the growth of the Thames Valley were the subdivision of the 42,000 acre Matamata estate in 1904 and the commencement of drainage operations on the Hauraki Plains in 1908. The one region grew as the other declined, and the centre of population moved westwards from the hill country to the bordering plains.

The new phase of land development had its origin in the technological, economic and social changes that were bringing about a revolution in land use at that time throughout most of New Zealand. The application of refrigeration to the production and transport of dairy produce, the demands of the land-hungry small settlers, and the determination of the state to break the stranglehold of the big landowners were among the general forces making for change. Within the Thames Valley itself, the barriers to closer settlement were now removed. The problems of land drainage and of the agricultural techniques needed to maintain high quality permanent grassland were being solved, and with the subdivision of the large estates access to the land was assured.

The development of the Thames Valley as a dairy farming region came after that of Taranaki and followed the peak of hill country bush burning between 1890 and 1905. The winning of pasture land from swamp was an expensive process, successful only when dairy prices could repay the high costs of development. During this century three concurrent trends can be seen in land development in the Thames Valley; the breaking in of fernland and the improvement of worn-out pastures on the light soils of the upper valley, the drainage of shallow peat swamps in the central portion, and the large state-operated drainage scheme on the heavy clays and deep peat swamps of the Hauraki Plains.

Land Development

The dry soils carrying fern or low-quality grasses were ploughed, cropped with oats or swedes, then sown to pasture and topdressed at regular intervals. On the shallow swamps between Matamata and

Te Aroha the original drains formed by the estate companies were widened and deepened, and together with others constructed by local drainage boards, gave outlets to farmers draining their own holdings. With burning and drainage the peat layer shrank and the soil gradually consolidated on the firm sands and clays beneath. Tree trunks of an ancient forest frequently came to the surface and had to be dynamited before the land was ready for the plough.

The drainage of the lower portion of the Thames Valley, the Hauraki Plains, is one of the largest and most successful land development schemes yet undertaken by the state in New Zealand. Here, extractive industry had preceded agricultural settlement. Flax milling had been carried on for several years but the swamps were regularly swept by summer peat fires, and the white pine forests, which for forty years had provided an export trade to Australia, were nearing depletion. Major operations in land development were the straightening and widening of rivers, the dredging of a canal to collect runoff from the western hills, the stopbanking of rivers and the foreshore, the excavation of a network of internal canals and drains, and the construction of roads, bridges and wharves.[16] Since the flow of water depended almost entirely on the range of the tides, pumping stations were built and floodgates installed where the drains crossed stopbanks. By 1914 32,000 acres had been reclaimed and were occupied by more than 270 settlers. At first there was an emphasis on the fattening of beef cattle, but as the land consolidated and transport facilities improved, dairying became predominant as in other parts of the valley.

As available land in the northern part of the valley has been taken up the scene of pioneer land clearance has moved southwards on to the pumice-covered 'downlands' beyond the borders of the Thames Valley on the margins of the volcanic plateau.

As land was drained and grassed, roads improved and electric power reticulated in rural areas, the settlement pattern, once rigidly confined to the railways and rivers, spread out evenly over the valley. Dairy factories appeared at close intervals and the growth of more intensive farming with large supplies of milk offering from small areas made possible the building of cheese and dried milk factories. During the land boom that followed the 1914-1918 war there was a marked inflow of new settlers from the southern provinces, especially Taranaki. The Herefords and Shorthorns which had formed the basis of the dairy stock in earlier years gave place to true dairy breeds, the Jersey and Friesian. Lincoln and Leicester sheep were replaced by Romney and

---

[16] 'Drainage Operations on Hauraki Plains', *Reports of Department of Lands*, 1908 *et seq.*

Southdown. As pastures were improved by regular topdressing and rotational grazing, the proportion of arable land declined. Hay and silage became the universal winter feed crops and the planting of shelter trees and hedges prolonged pasture growth and gave badly-needed protection to livestock. All these improvements were reflected in a steady increase in carrying capacity per acre and in production per cow. Within thirty years the face of the Thames Valley was completely transformed, and from a region of comparative insignificance it grew to be an important contributor to New Zealand's wealth.

A CHANGING LANDSCAPE

The new era that opened with the rise of the frozen meat and dairy industry also had its effects on the Coromandel Peninsula. Gold, timber and gum had helped to enrich Auckland but could not provide a stable and permanent basis for settlement on the peninsula. Fortunately the working out of the timber and mineral resources coincided with the growth of the new pastoral industries. Quartz batteries and sawmills were dismantled and removed. Fern, gorse and blackberry grew over the site of mining operations. Scarred hillsides were gradually healed with second growth forest and cyanide-polluted streams ran clear again. The population declined as miners went to the coalfields or the cities. Some moved out on to the newly developed farmlands of the Thames Valley and with them went many miners' cottages to become milking sheds and farmhouses on the plains.

Attention was also turned to the agricultural possibilities of the peninsula. Previously farming had been restricted to the raising of a few dairy cows and sheep around the mining camps. After 1900 there was a rapid increase in bush burning to clear hillsides for sheep grazing while at the same time coastal flats were ploughed and sown to pasture for dairying. The pastoralist generally followed the sawmiller and gum digger and burned once more the tangled wreckage of cut-over bush and second growth. Some areas were grazed sporadically for a few years and then abandoned as pastures reverted to scrub and fern. Only in scattered patches along the west coast between Cape Colville and Thames have stable hill pastures been established.

Perhaps the most remarkable change on the peninsula in the last thirty years has been the transformation of the Waihi Plains. Forty years ago this area was a desolate, windswept expanse of fern and manuka. Its rhyolitic ash soils were considered worthless. Development began when gold miners turned part-time farmers and took up small sections. Topdressing with phosphates and potash resulted in marked improvements in pasture growth and butterfat yields per acre rose steadily. Easy to plough and requiring no expensive drainage or bush-felling operations, the Waihi Plains have been among the cheapest areas to develop for dairying in New Zealand.

Such were the processes by which successive types of economies have altered the primeval setting. Viewed in perspective, the settlement of the Thames Valley has been but part of the northward drift of population in New Zealand during the last fifty years. The impetus for development came from certain technical and economic changes that enabled the nation to capitalise the climatic advantages shared by the lowlands of the North Island. Coincident with this change came the exhaustion of the resources on which the economy of the Coromandel Peninsula had been based. Expressed in another way, the city of Auckland came to rely less on the timber, gold and kauri gum of the northern peninsulas, and more on the grass and butterfat of the lowlands to the south.

THE ORIGIN OF SCHIST TORS IN CENTRAL OTAGO

J. D. RAESIDE

THE FOSSIL PLAINS of Otago, now bleak treeless uplands, have their surfaces broken by countless schist tors, irregular columns and masses of mica schist, many of which show cavities and hollows similar to those which have been attributed elsewhere to wind abrasion and scouring (*Fig.* 1). Finlayson[1] in 1908 emphasised the part played by rock jointing, and considered that the tors were formed by weathering along joint planes. He attributed the apparently wind-scoured cavities 'to changes in temperature, and to freezing, and subsequent disintegration,' advancing in support of this contention the fact that the cavities generally faced north. Cotton[2] in 1917 attributed the tors to the present semiarid cycle of erosion, mainly on the grounds that as the humid climate of the coast was approached the tors became fewer and they did not occur on the wet coastal uplands. He claimed that the surface 'was deeply and irregularly weathered before the deposition of the covering strata' and that 'whether differential weathering is or is not still going on, weathered material is being removed from the surface of poorly protected soil, and it is thus that the tor pattern was etched out.' Williamson[3] in 1939 concurred in this view. Cotton[4] later, in 1942, describing an illustration of some of these wind-scoured tors, referred to them as 'tors of schist rock scoured and undercut by aeolian abrasion which has been stimulated by recent depletion of the natural vegetation.' This statement seems to suggest that he regarded the cavities as the work of wind abrasion and that they were the product of the present cycle of accelerated erosion.

In this brief discussion of the origin of the tors only those scattered over remnants of the ancient fossil plain have been considered. V-shaped valleys incised in the fossil plains, and fault scarps bounding them, also show many rocky outcrops, but these rock forms are characteristic of normal geological erosion of steep slopes of mica schist where the rock is not everywhere of uniform hardness. To simplify discussion, Cotton's view that the cavities are caused by wind abrasion will be adopted here. It is more plausible than Finlayson's hypothesis because under normal weathering, where sand blast can be excluded, the laminations of the schist tend to be exaggerated and the surface presents a pattern of irregular ridges. Smooth cavities and hollows do not commonly occur.

---

[1] A. M. Finlayson: 'Some Observations on the Schists of Central Otago', *Trans. N.Z. Inst.*, Vol. 40, 1908.

[2] C. A. Cotton: 'Block Mountains of New Zealand', *American Journal of Science*, Vol. 44, No. 262, 1908.

[3] J. H. Williamson: 'Geology of the Naseby Subdivision', *N.Z. Geological Survey Bulletin No. 33*, 1939.

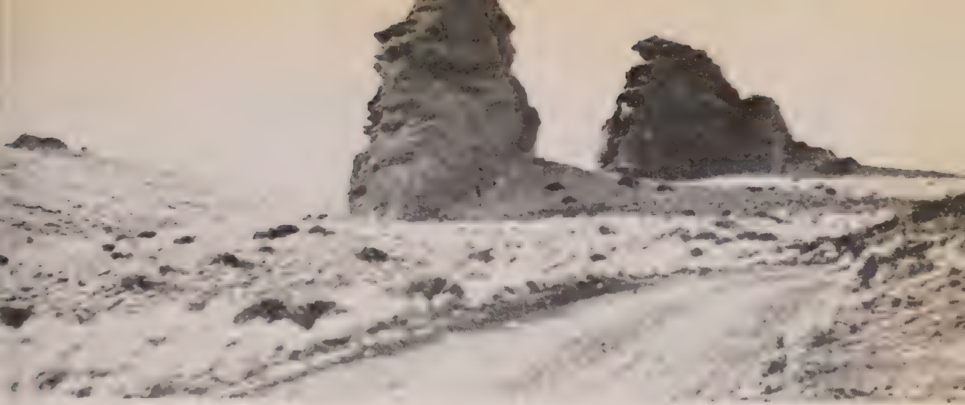
[4] C. A. Cotton: *Climatic Accidents*, Wellington, 1942.

In considering the current views of the origin of the tors the significance of the climatic pattern must be emphasised. The attribute semiarid' has been hitherto attached to the Central Otago landscape n a loose connotation. It has been implied that Central Otago could be regarded as falling within a single semiarid climatic unit. This is a misleading simplification, for the climate of only a small part of its total land surface is strictly semiarid. In a region, no part of which lies more than a hundred miles from the coast, aridity is determined by the disposition of the mountain masses. These shelter the valleys from the rain-bearing winds and receive on their upper slopes an excess of rainfall and humidity. As the Central Otago landscape is one of relatively high relief, its climatic pattern is complex, and only the lower flanks of the mountain sides and the floors of the intermontane valleys and basins can properly be called semiarid. Thus, although the climate of the Taieri Valley, for example, is semiarid, the adjacent uplands on the summit of the Rock and Pillar Range support a sphagnum bog five miles long and over one mile wide at its widest point. Consequently the Central Otago climatic pattern is best regarded as a mosaic of damp cold uplands, dry valley floors and intermontane basins.

The distribution of wind-scoured tors, however, is in no way related to this climatic mosaic. Except on the coastal uplands the tors are widespread over the whole of the fossil plains irrespective of whether the schist surface lies at a low elevation, or on high uplands. Between the Rock and Pillar Range and the coast, the tors become fewer as the coast is approached, but a few persist almost to the edge of the plateau overlooking the Taieri Plains (for example the huge tor on Maungatua). Cotton's view that the wind-sculptured tors are products of the present erosion cycle is thus open to objection. It seems more likely that the present climatic gradient from the humid coast to the dry interior has had no part in forming the tors, although it has controlled the weathering of tors already in existence. On the coastal belt of schist upland where only a few tors survive, the schist weathers rapidly and in places from ten to twenty-five feet of weathered schist, reduced to a yellowish brown sandy silt loam and still retaining traces of the laminations of the schist, overlies the unweathered schist. West of this belt, (west of a line about thirty miles inland from the coast and roughly parallel with it), there is only a thin veneer of weathered schist, and unweathered rock reaches to within two to three feet of the surface. The tors would therefore appear to be features of the fossil plain and to have survived to a greater or less extent according to the intensity of erosion to which they have been subjected since the dislocation and stripping of the plain.

Further evidence that the tors are fossil is provided by their appearance through a cover of Tertiary sediments in at least two places. Near Linnburn Station, in the southwestern corner of the Maniototo Basin, on the low-lying remnants of the fossil plain which here dips gently northeastwards under the late Tertiary sediments of the basin, there are still preserved outliers of the cover of older Tertiary sandstones, silts, clays and grits, through which typical tors are emerging as the sediments are stripped from the schist surface (*Fig.* 3). The outliers were deposited prior to the Kaikoura orogeny for they lie on the schist surface and have been tilted and dislocated with it. These tors must therefore at least antedate the Miocene.

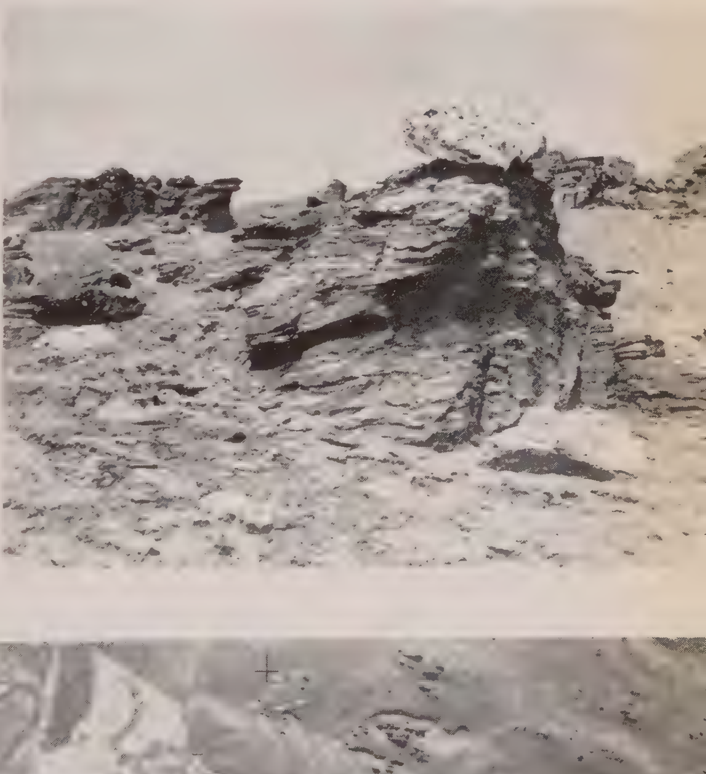
In the southwestern part of the Ida Valley, on the schist upland near the Galloway saddle, a remnant of the sheet of siliceous cementstone from which the 'sarsen' stones ('chinamen' of the gold diggings) were derived still remains in a shattered and disintegrated condition. Among the fragments of cementstone, some of which are upwards of five feet in length, there are many schist tors up to eight feet in height. On two of these tors 'sarsen' stones are perched, (*Fig.* 2), one weighing probably rather more than one third of a ton and the other about one quarter of a ton. The siliceous cementstone is separated from the schist basement by several feet of sands, grits and gravels, so it would appear likely that when the cementstone band was *in situ* it stood several feet above the summit of the highest tors, and that it has been lowered to the schist basement through the undercutting and erosion of the soft underlying beds. It is unlikely that the tors were formed by erosion of the schist after the deposition of the sediments because reduction of the schist surface by even three feet would be sufficient to remove all vestiges of the original Tertiary cover. Although the evidence here is not conclusive in itself it makes it more likely that these tors also are fossil landforms buried and preserved under the group of sediments, of which the cementstone was a member, than that they have been formed by erosion of the schist after the partial stripping of the cementstone band.

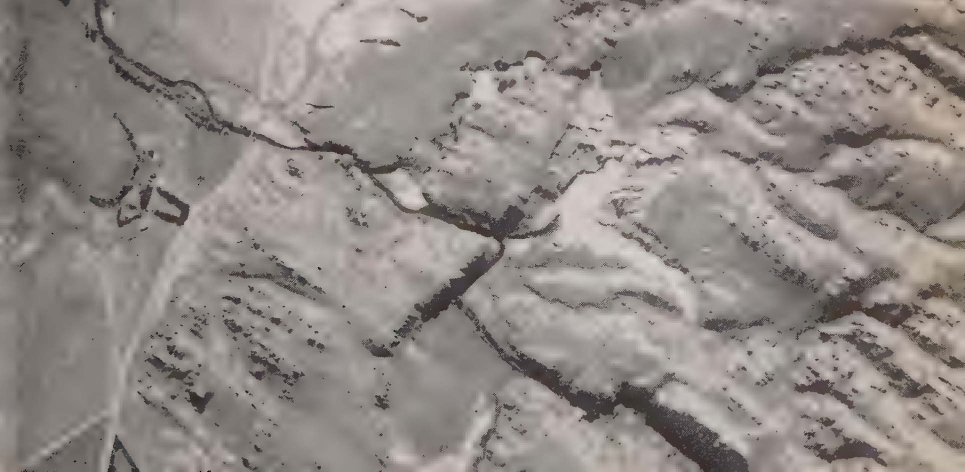


chist tors on an elevated
of the fossil plain.
Saddle between Ban-
n and the Nevis Valley,
summit of the Carrick
Altitude 4,300 feet.

chist tors emerging from
of Tertiary sediments in
per part of Ida Valley,
wo miles southwest of
eek school. The inter-tor
s littered with fragments
nd of siliceous cement-
member of the Tertiary
, and a large fragment
' stone or 'chinaman') is
on the tor in the fore-

erial photograph of tors
Taieri bridge on the
-Styx road. The Cale-
Diggings, excavated in
sediments, can be seen
sharp bend in the river.





The age of the sediments of which the cementstone is a member has not been determined accurately, but the consensus of opinion is that they are of Miocene age. They are involved in the block faulting, and lie at the base of the Tertiary sequence, being separated from the schist basement by less than fifty feet of grits and gravels.

From the evidence collected, the date of formation of the tors can only be conjectured. Some of them, at least, must antedate the Kaikoura orogeny. Their wide distribution over the fossil plain suggests that they may belong to the latest stage of peneplanation of the schist surface, and that they were buried and preserved under the sediments which later covered it.

The date at which the wind-scoured features were added to the tors is uncertain, but it is clearly not the work of contemporary wind abrasion. Even under the present dry climatic conditions prevailing on the valley floors and the lower slopes of the mountains, practically no wind abrasion of the tors is taking place in spite of the highly accelerated erosion of the current regime. Moreover, nowhere in Central Otago are there the accumulations of wind-borne sands which might be expected if sand had played any significant part in shaping landforms in post-Pleistocene times. Post-Pleistocene wind scour therefore would appear to have been relatively insignificant. If the cavities and undercut forms of the tors are due to wind erosion, they must antedate the Pleistocene. The wind scouring could have been done at any time since the exposure of the tors, or before their burial.

Many tors near the eastern margin of the belt are bounded by plane surfaces, some being almost rectangular in horizontal section, with no signs of wind scouring. Some of the hollows and undercut forms appear to have been added during a pause in the erosion of the covering sediments. A few miles southeast of Linnburn Station, in the upper Taieri Valley, many tors are eroded in this way only on their upper parts, while the lower parts are still more or less flat-sided. This could be explained by a pause in the stripping of the Miocene beds, during which the surface suffered little reduction, but wind, or the particular erosive agency which caused the rounded forms, was active. During the stripping of the covering sediments there may have been a desert period which reduced the rate of erosion of the surface and provided a supply of sand for the work of wind abrasion, or, if the rounded forms were the work of normal weathering, they may possibly be due to the accelerated freeze and thaw of the Pleistocene glaciation.

THE FORM AND FUNCTIONS OF NORTH CANTERBURY TOWNSHIPS

THE NORTH CANTERBURY region to which the illustrations in *Photogeography* apply is an area economically tributary to the metropolitan centre of Christchurch. It extends from Kaikoura in the north to the Rakaia River in the south. Much of it is high mountain country in which the only permanent settlement is scattered along the river valleys that penetrate the highland. The core of the region is the Canterbury Plains where is found most of the rural population on which the prosperity of the urban centres rests. North of Amberley the plains give way to range-and-basin country and downland, with most of the people concentrated in valley or basin lowland, or along the coast as at Kaikoura.

As settlement of the rural region progressed, small townships were founded at several places. Some of these have made little progress; others have developed to considerable size because they service richer and more closely settled portions of the plains; still others have grown out of their special functions as factory centres. In every case, however, the town is an integral part of the rural countryside and its main function is to serve the rural farming population. Some of the country towns that are representative of the urban settlement of North Canterbury are depicted in the accompanying series of aerial photographs.

The general view of the Canterbury Plains, looking inland and northwestwards to the Southern Alps, reveals the expansive and predominantly agricultural and rural character. Such is the setting of the townships on the plains. Almost lost in the rectilinear pattern of fields, farms and fences is the small township of DUNSANDEL on the main road and railway running south from Christchurch to Dunedin. It is the centre of one of the more productive and finely-divided portions of the plains, and the coming of motor transport and of tar-sealed roads has accelerated its growth.

North Canterbury has few coastal towns. Three are illustrated here: Akaroa, Kaikoura and Lyttelton. AKAROA is of especial interest as the centre of earliest urban settlement in Canterbury, being founded by French colonists in 1840. Isolation from the plains hindered its growth, and rural Banks Peninsula (which it served) has steadily declined in population. The town was built on the limited area of flat land along the waterfront and sent strings of semi-rural settlement up the main valleys immediately behind it. Such land is restricted in area so that building sections in what is now a very popular holiday resort are difficult to obtain.

KAIKOURA, properly within the provincial district of Marlborough, looks mainly to Christchurch city in commercial affairs and is from this point of view within the North Canterbury region. Built on a strip of flat land along the edge of the peninsula it long served the local rural community, whose major means of access was by sea. With the coming of motor transport, coastal shipping and the local port declined. The completion of the South Island main trunk railway has given it a new lease of life which is expressed in the extent of recent building at the northern end of the town. The new railway station is in the middle of the picture, and the main activity in the town is now in its vicinity.

LYTTELTON, like Akaroa, grew in a sheltered harbour of Banks Peninsula, but its proximity to the plains and the early construction of the Lyttelton railway tunnel, made it the main port of Canterbury. The picture, however, shows clearly the limitations of its site, and the manner in which the town has grown around the base of the enclosing hills. A tunnel road is now projected and this would be the means of providing still better access to the city of Christchurch.

DARFIELD is typical of the small towns on the Canterbury Plains. The photograph forcibly reveals its situation at the junction of communication lines. From the main West Coast railway a branch line runs to the Malvern Hills coal-mining district. The main road to the west also passes through the town which has grown where this is met by a net of tributary rural roads. Because it is uncommonly well placed as a centre for servicing the rural countryside this town, although still small, is growing steadily.

ROLLESTON is a railway junction fourteen miles from Christchurch. In spite of the advantage its site as a main junction gave it, the village has not grown, mainly because here the Canterbury Plains consist of poor stony land. The poor quality of the land finds expression in the eucalypt plantation and the weed-infested fields in the foreground.

WAIKARI is a little ribbon town strung along the road that skirts the edge of a typical North Canterbury basin. Stores, railway station, hotels and school together with a few dwelling houses comprise the village unit. Here limestone is quarried and crushed for supply to farmers within a wide radius.

LEESTON and SOUTHBRIDGE developed early as centres servicing the people of the rich farmlands in the vicinity of Lake Ellesmere. The rivalry between these urban centres was accentuated with the development of motor transport. Southbridge was once twice the size of Leeston, but has been making little if any progress for the last forty years. A comparison of the two pictures shows Leeston to be much better equipped, with relatively new dwelling houses and more shops and commercial offices.

A few North Canterbury towns have special forms or functions. BELFAST is one of these. It is a centre of the meat-freezing industry. In the foreground is one of its two large plants about which the town has been laid out in an orderly square pattern. The main north road is in the middle distance, and in the distance just off the photo is the Waimakariri River. In the immediate vicinity of the river the farmland was liable to flooding but is now protected by extensive control works.

AMBERLEY, at the northern end of the Canterbury Plains proper, is at the junction of hill and plains. This is reflected in one of its major functions; it is the site of large saleyards and, in addition to its regular livestock sales, it has an important annual ewe fair. The main road and the railway to the north pass through it, and it is a centre of local service to a rich farming area.

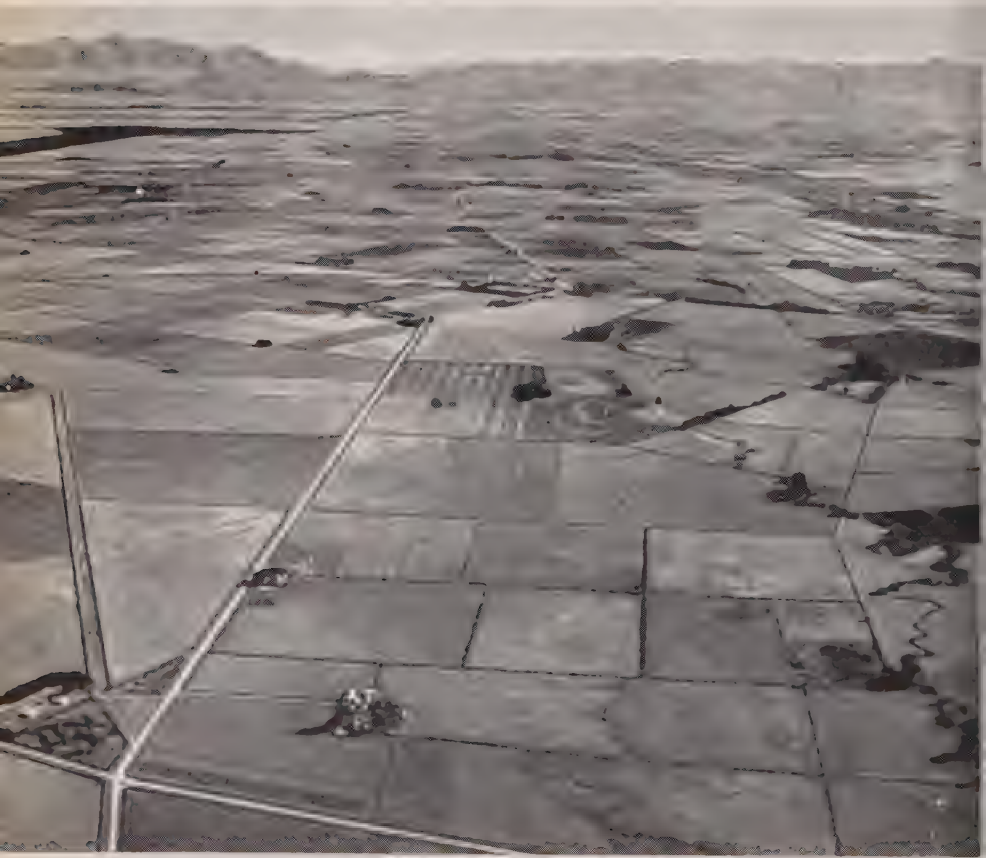
RANGIORA is the largest town in the region outside the city of Christchurch from which it is only twenty miles distant. It serves a rich hinterland; the land in its immediate vicinity was once a swamp and is now first class farmland. The photograph demonstrates the orderly pattern of this prosperous and progressive town.

PHOTOGEOGRAPHY

A PICTORIAL SURVEY OF NEW ZEALAND

3. NORTH CANTERBURY TOWNSHIPS

Fig. 1. *The Setting: The Canterbury Plains, near Dunsandel.*



All photos: V. C. Browne

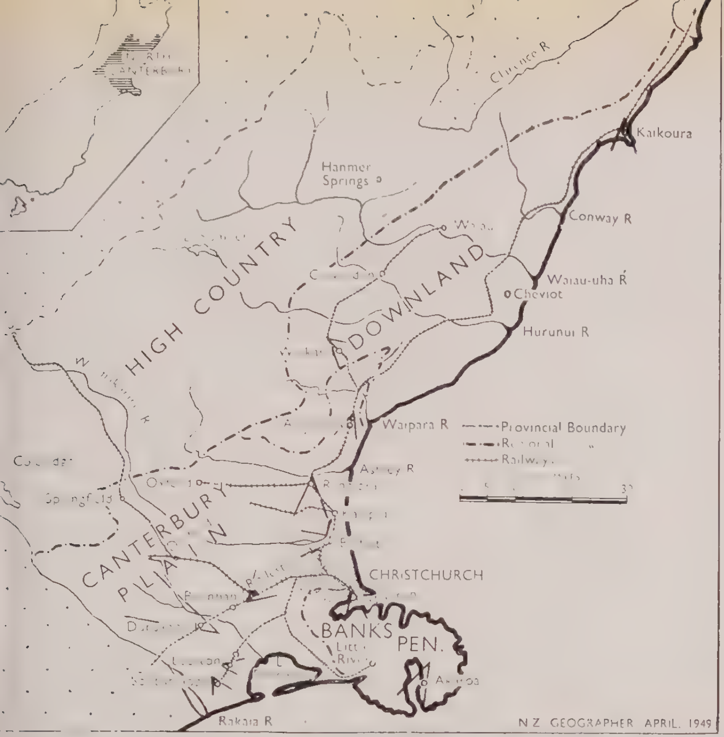


Fig. 2. *Location Ma*
Arrows mark approxim
position of air views.

Map drawn b
R. H. Wheel

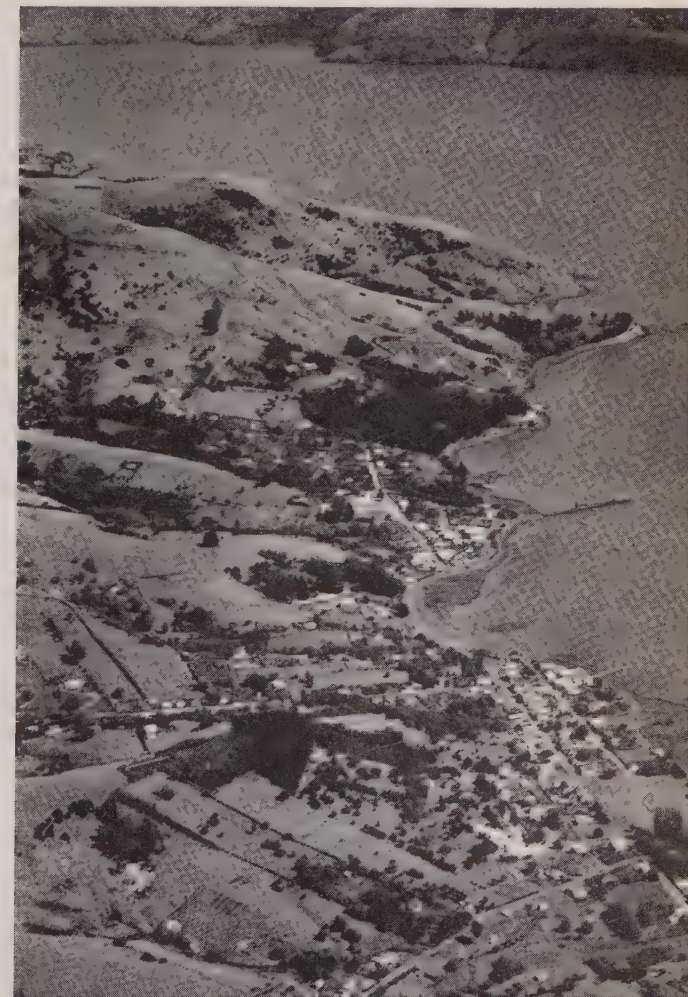


Fig. 3. *Akaroa*

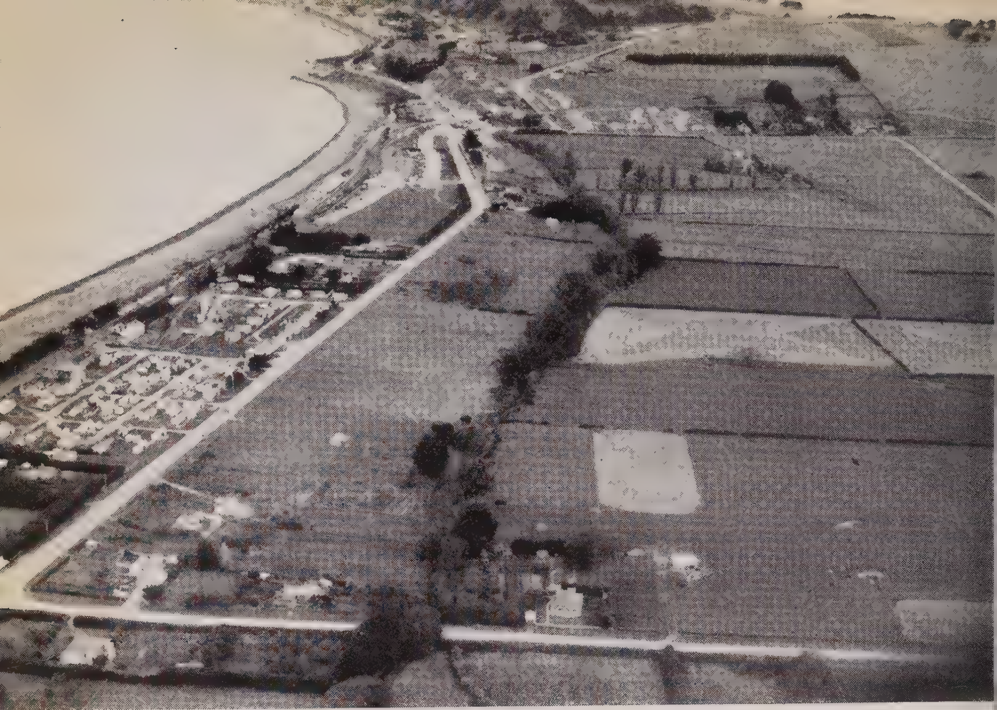
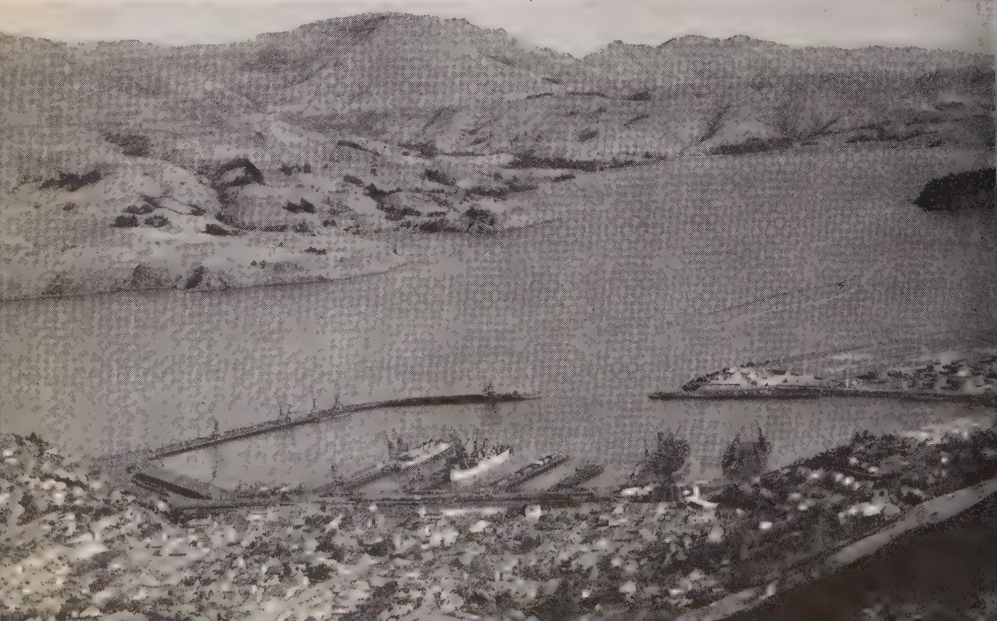


Fig. 4. *Kaikoura*

Fig. 5. *Lyttelton*



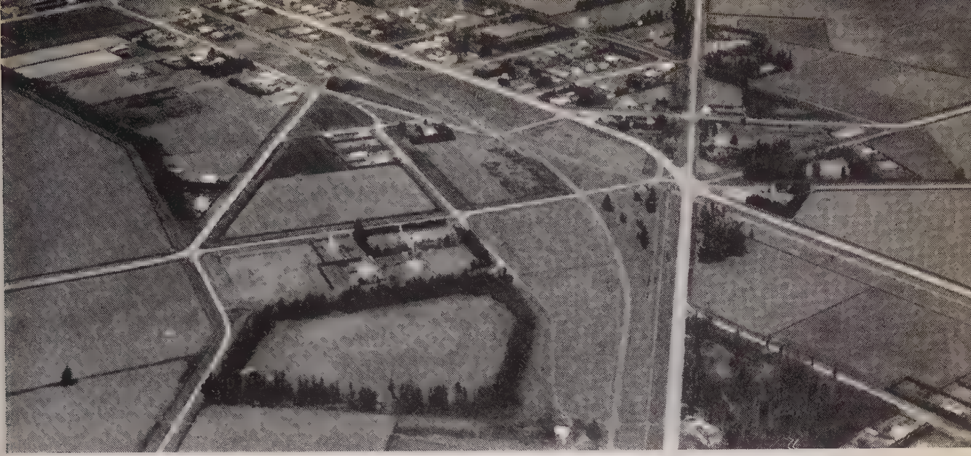


Fig. 6. *Darfield*

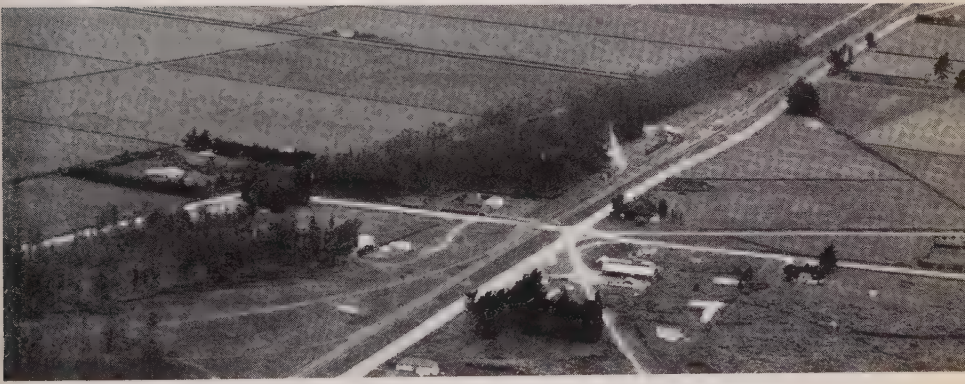
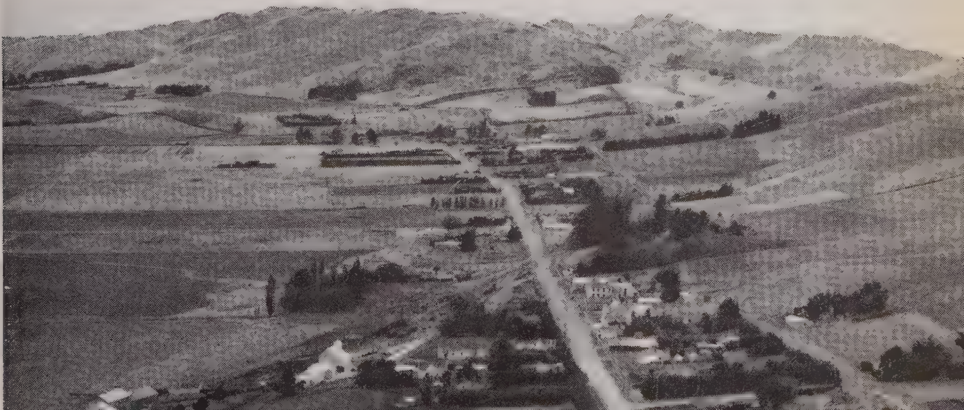


Fig. 7. *Rolleston*

Fig. 8. *Waikari*



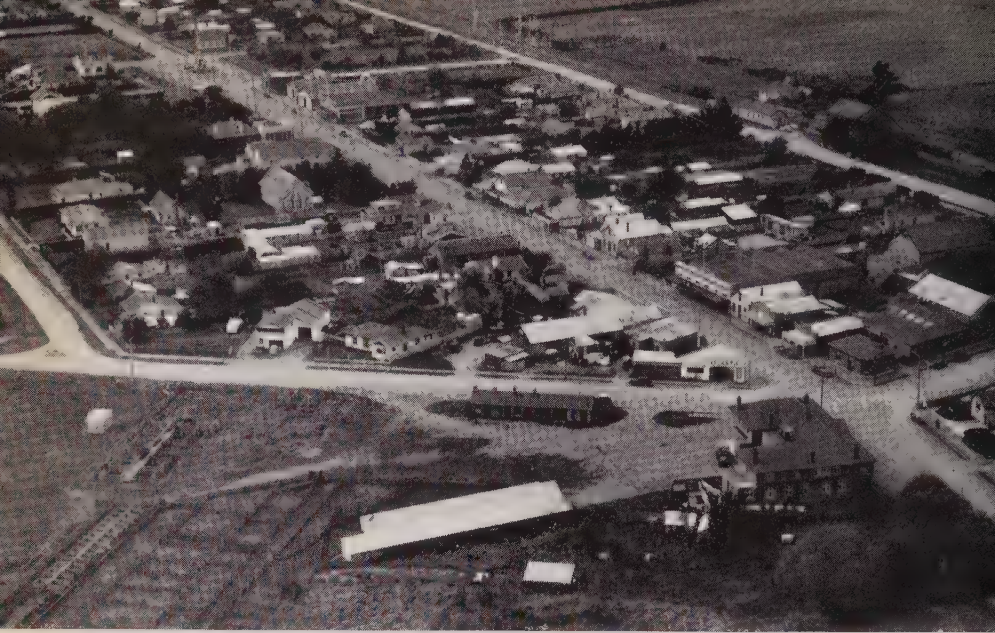
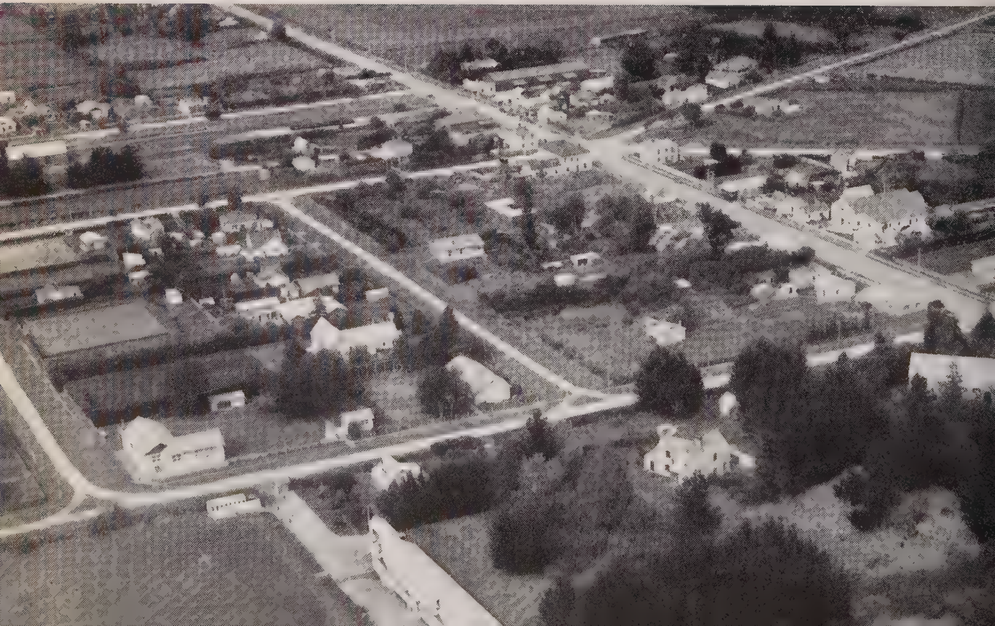


Fig. 9. *Leeston*

Fig. 10. *Southbridge*



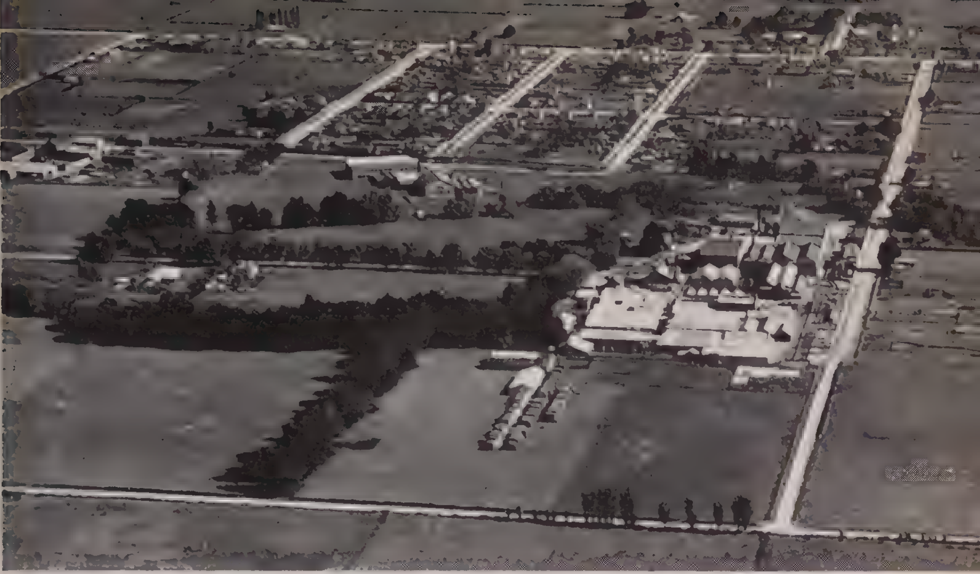


Fig. 11. *Belfast*

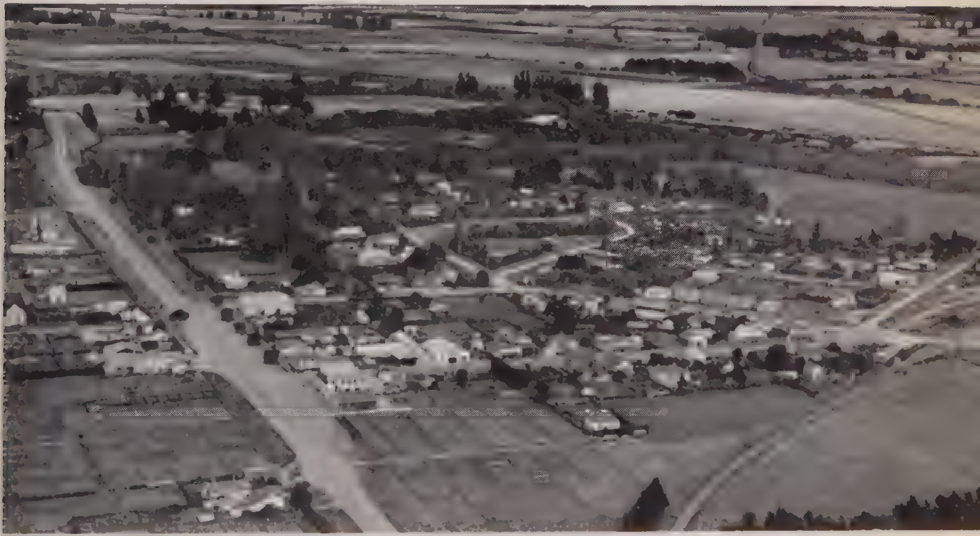
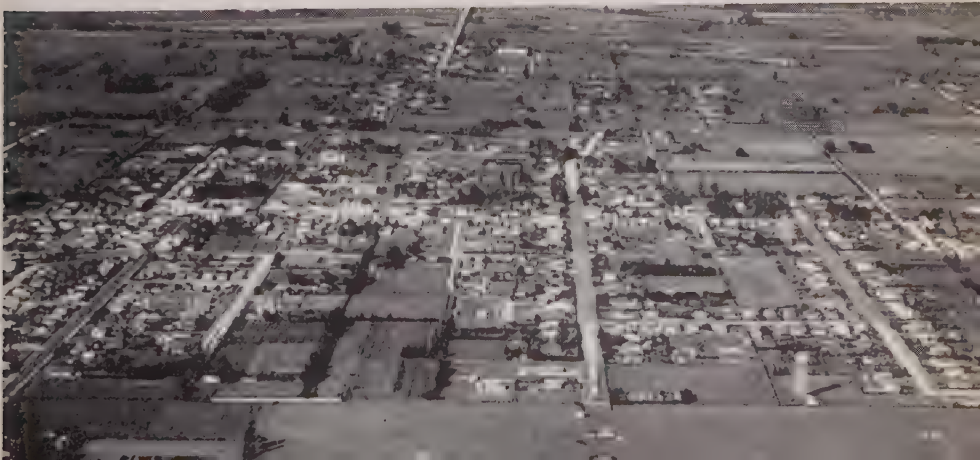


Fig. 12. *Amberley*

Fig. 13. *Rangiora*



NEW ZEALAND GEOGRAPHICAL SOCIETY: BRANCH AFFAIRS

CANTERBURY BRANCH

OFFICERS for 1949 are— *President*: Mr. W. S. MacGibbon

Vice-Presidents: Mr. J. Acland, Dr. G. Jobberns, Mr. J. L. Hewland

Chairman: Mr. H. J. Critchfield

Secretary-Treasurer: Mr. A. V. Barley *Hon. Auditor*: Mr. W. Rosenberg

Committee: Miss N. Clark, Messrs. A. C. Pitcaithly, Y. T. Shand, H. M. Sweney

Recorder: Mr. M. McCaskill

The annual general meeting of the Canterbury Branch, 1948, concluded with a Brains Trust discussion on 'Immigration in the Development of the South Island'. The panel of speakers consisted of Mrs. O. D. Suggate, Mr. R. R. Livingstone, Mr. W. Rosenberg and Mr. H. C. Urlwin, with Mr. L. W. McCaskill as question master. The evening was marked for its spirited discussion and proved one of the most interesting of the 1948 session.

Meetings are again being held on the second Wednesday of each month from March to October inclusive in Hay's Lounge at 8 p.m. It is hoped to hold further field excursions during the year; details will be announced in the monthly meeting notices.

We are particularly pleased to welcome Mr. H. J. Critchfield to the branch and are honoured to have him as our chairman.

WELLINGTON BRANCH

OFFICERS for 1949 are— *President*: Dr. R. A. Falla

Vice-Presidents: Mr. D. I. Macdonald, Mr. Alan Mulgan, Mr. R. J. Waghorn

Chairman: Mr. N. E. Dalmer

Secretary: Miss J. K. Finney *Treasurer*: Miss B. Page

Publicity Officer: Mr. D. W. McKenzie *Hon. Auditor*: Mr. T. L. James

Committee: Mrs. S. Turowski, Mr. G. Anderson, Mr. R. P. Graham

An attractive programme, including topics by New Zealand as well as overseas speakers, is planned by the committee for this year. Meetings will again be held on the third Wednesday of each month from March to October and film evenings will be arranged for the winter months in addition to the lecture programme. The annual meeting of the New Zealand Geographical Society will be held in Wellington in June.

A publicity campaign designed to increase the membership and activity of this branch will be launched early in March and public lectures will be held in conjunction with this membership drive.

AUCKLAND BRANCH

OFFICERS for 1949 are— *President*: Professor H. R. Rodwell

Vice-Presidents: Professor J. A. Bartrum, Professor V. J. Chapman, Sir Albert Ellis, Mr. L. K. Munro, Dr. G. Blake Palmer

Chairman: Mr. R. A. Watson

Deputy Chairman: Mr. N. Pountney

Hon. Secretary: Mr. A. L. Ferguson *Hon. Treasurer*: Mr. R. M. J. McDermott

Hon. Auditor: Mr. J. K. Bedbrook

Committee: Miss I. Kirk, Mr. A. R. Harvey, Mr. G. G. Harvey, Mr. R. G. Lister, Mr. J. H. Martin

The annual general meeting of the Auckland Branch took place on 26 October when the presidential address 'Commonwealth Relations' was delivered by Mr. L. K. Munro to a highly appreciative audience.

An attractive programme has been arranged for 1949 and the policy of having film evenings will be continued. The meetings will be held on the first Tuesday in each month with film evenings interspersed.

It is hoped that the lectures will attract more members and the branch looks forward to a successful year.

OTAGO BRANCH

OFFICERS for 1949 are— *President*: Mr. B. J. Garnier

Past-President: Dr. B. H. Howard

Vice-Presidents: Mr. P. G. Connolly, M.P., Mr. A. H. Payne, Mr. G. Simpson

Chairman: Mr. W. E. Earnshaw

Secretary-Treasurer: Mr. W. F. Reid *Hon. Auditor*: Mr. G. S. Kirby

Committee: Miss R. Coxhead, Miss D. M. Martyn, Miss L. C. Voller, Mr. N. Dew, Mr. R. H. Greenwood, Mr. W. R. Mayhew, Mr. D. Sage

In the latter half of 1948 this branch had several very interesting evenings. One film evening was held, when three films on varied topics were seen. In July, Dr. R. Nimmo, who has recently come to Dunedin as Professor of Physics at the University of Otago, spoke on 'The Geographical Implications of Atomic Power'. Dr. Nimmo took a prominent part in atomic research in England and then in the United States. We were also fortunate to hear Professor G. A. Knight talking of his travels in Europe at the beginning of the war.

The activities of the branch for the year came to an end in October with the annual general meeting, at which Mr. B. J. Garnier delivered his presidential address, his subject being 'Some Problems of Our Time'.

GEOGRAPHIC NOTEBOOK

CONTRIBUTORS TO THIS ISSUE. The first part of the last volume (April, 1948) of the *New Zealand Geographer* was devoted almost entirely to the geography of the Pacific. In February this year New Zealand acted as host to the Seventh Pacific Science Congress, and it is hoped that our next issue might again range over the Pacific realm. Meanwhile, however, Dr. Kenneth B. Cumberland, head of the Department of Geography at Auckland University College, reports on his visit last year under the auspices of the University of New Zealand Research Grants Committee to Fiji, Tonga, Samoa and the Cook Islands. His report is a general review of the agricultural prospects of these scattered island territories.

The Department of Geography at Auckland University College is also responsible for an article describing in detail the results of a field survey of land utilisation conducted during February 1948 in the interior of the North Island. Messrs. James W. Fox and R. G. Lister are lecturers on the staff of the department and are graduates of the University of London. Both arrived in New Zealand early in 1947. Their survey of land utilisation in the North Island is being rapidly extended throughout the recently developed agricultural areas of the King Country and the volcanic plateau.

Mr. Murray McCaskill graduated from Canterbury University College in 1946 and is now assistant lecturer on the staff of the Department of Geography there. His contribution is a condensation of a thesis submitted for the Master's degree in 1947.

The *New Zealand Geographer* has previously published contributions from the Grasslands and Plant Diseases Divisions of the New Zealand Department of Scientific and Industrial Research. In this issue we have the privilege of including a brief note on the geomorphology of Central Otago from the Soil Survey Bureau. Mr. J. D. Raeside, pedologist with the bureau, accepted a temporary appointment as scientific liaison officer in Washington just after he had submitted the present paper for publication.

Mr. Stuart Duncan is one of the growing number of graduates in geography of the University of New Zealand who have been attracted to the government service. He is attached to the centennial atlas section of the Historical Branch, New Zealand Department of Internal Affairs, and intends to proceed to England this year to undertake postgraduate studies in geography. The photographs assembled here in *Photogeography* were collected by Mr. Duncan and used to illustrate his thesis for the Master's degree in geography.

Among contributors to reviews and other short notices in this issue are: Professor G. Jobberns, Canterbury University College, Christchurch; Mr. John Reid, Auckland University College; Mr. L. L. Pownall and Mr. N. H. Whatman, Ardmore College, Papakura; Mr. L. W. McCaskill, Canterbury Agricultural College, Lincoln; Mr. Roger Duff, Director, Canterbury Museum, Christchurch; Mr. P. D. Sears, Department of Scientific and Industrial Research, Palmerston North; Mr. N. V. Scarfe, Institute of Education, University of London; and the editorial staff.

SEVENTH PACIFIC SCIENCE CONGRESS. Although no specifically regional studies were included in the programme of the Seventh Pacific Science Congress, much material of value to geographers was included within the scope of several divisions of the congress. Significant contributions to several branches of systematic geography were made by papers presented in the Divisions of Soil Resources, Forestry and Agriculture, Meteorology, Botany, Anthropology, and Social Sciences. Publication of papers in the forthcoming volumes of *Proceedings* will be awaited with interest, though it has not been found possible to undertake publication of papers in full. Reference can be made here only to a few selected items.

The symposium on *Economic and Power Resources of the Pacific*, in the Social Sciences Division, was among those of greatest interest. Prospects of future industrial development in Australia were examined by Professor G. L. Wood in the light of the demands of the greater population now being planned for, and its reliance upon the available power resources. Coal reserves as at present known do not promise an adequate foundation in the long run for heavy industry, and the expansion of water-power resources is severely limited. Coordinated plans must be made with agricultural bodies for the fullest use of all available water resources. Professor J. W. Coulter reviewed the resources of the Pacific islands and the extent to which they are recovering from wartime damage and disorganisation. He stressed that although the present phase is one of general prosperity with products in great demand, there is need for caution in allowing commercial progress to continue on the basis of possible short-term demand. An informative paper on the many phases of development to which water resources contribute in the northwestern states of the U.S.A. was presented by Howard J. Critchfield of Canterbury University College; over forty percent of the developed water power of the U.S. is concentrated there, and new industries utilising it have grown up in recent years.

A study of an entirely different type of industrialisation was that of the Chinese Industrial Cooperative movement, sent in by the central office of the movement, and including a contribution by Rewi Alley, the New Zealander in charge of the INDUSCO training school at Shantan in North China. The movement has received no encouragement from Nationalist China since the war, in spite of its amazing contribution to production during war years, but it promises to be a major feature of the new 'Communist' China, indicated by its present rapid growth in the north.

A valuable series of papers on *Changing Agricultural Economy in the Pacific Islands* was included in the Anthropology Division. It is evident that new foods and amenities of life are to be increasingly demanded by peoples of the islands as a result of their contacts and experiences during war and postwar years, and they are likely to favour an increase of commercial forms of agriculture in order to satisfy their tastes. The extent to which this process is already under way, and the function of administrators in permitting it, or fostering it in island groups at various stages of cultural development, formed subjects for frequent discussions; danger in producing unbalanced economies, not in the first instance aiming to provide local food supplies, was clearly seen. Dr. Kenneth B. Cumberland of Auckland University College reviewed the situation in the southwest Pacific in a paper that incorporated many of these themes.

Several aspects of the position and problems of the Australian aborigines were dealt with by Professor A. P. Elkin, of the University of Sydney, who looked forward to the time when they will be accepted as Australian citizens in the widest sense.

Under the chairmanship of Sir Peter Buck, a paper on the Maori population was given by Professor I. L. G. Sutherland of Canterbury University College, examining the present situation and reminding the division of the rapid changes during the course of the present century. New Zealand is fortunate to possess no half-caste problem, in which neither race will accept those of mixed blood as members of their communities. In his comments from the chair at this meeting, Sir Peter expressed his hope that in the new ways of life they are adopting, the Maori people will preserve the functions of the meeting house and the *marae*, around which progressive ideas can be fostered in country and town, while maintaining the traditional spirit of community life.

Dr. C. E. Kellogg's happy personality and breadth of views ensured the success of a series of sessions on *Soils and Land Classification.* Papers were read on the work of soil surveys in Australia, New Zealand, Java, Canada, the Philippines, U.S.A. and Great Britain. Considerable attention was devoted to further work on land capability or potentiality, in which soil surveys are fundamental. Land capability assessment is now an integral part of the work of the Soil Survey in U.S.A., incorporating in the conclusions reached, the advice of other bodies concerned with the problems involved. These assessments need frequent revision in the light of technical progress if they are to be of value to the farmer in formulating his farm programmes. New Zealand has good work to show in each of these fields, but much work has to be done from the land classification viewpoint, in which the present land utilisation map forms the initial step. Close attention was paid to field work on soil morphology, and Dr. Kellogg stressed that a soil sample in the laboratory is no more a soil than the leaves in the family bible are plants. Site, vegetation cover, etc. are essential to soil research. In this respect, it was interesting to learn that further research into the North Auckland 'podsols' is desirable before we accept them as zonal podsols. During excursions, overseas soil scientists took many opportunities of indicating the seriousness of soil erosion forms that were evident, even to their superficial view.

In all sessions dealing with agriculture, soils, forestry, botany, zoology and many aspects of anthropology, two dominant themes were constantly present in discussion. The first was the need for conservation measures to combat too rapid a change that may lead to disastrous consequences; and the second was the need for more research upon which conservation measures can be more wisely formulated. At all stages it was evident that we need to widen our knowledge of the processes at work bringing changes into being, whether it be with reference to such widely different subjects as the influence of introduced flora and fauna into New Zealand, or the effect of new ways of life upon remote islanders.

By no means all of the business of the congress was conducted by academic discussion. Highlights of an exciting character were afforded by the spectacular colour film of the growth of Paracutin, the Mexican volcano which began in February 1943 as a crack in a ploughed field, to pour out an average of two million tons of material daily for its first eight months of life, thus forming a cone almost 1,100 feet high and lava flows extending six miles. Major W. S. Barney of the U.S. Air Force at Guam described the work of his unit in locating and photographing incipient typhoons, and related how his B29 (Superfortress) was structurally damaged in the course of an amazing flight into the eye of a typhoon at a height of only 1,500 feet; and E. G. Bowen of the C.S.I.R., Melbourne, illustrated an account of successful rain making by superb photographs showing the effects of dropping dry ice into appropriately selected cumulus cloud formations.

Quite apart from formal meetings, much useful work will be done as a result of contacts made between so many scientists from all the countries interested in Pacific problems, and from their personal contacts with New Zealanders. It is hoped that a division to include geographic studies will be provided in the programme for the eighth congress which is to be held in the Philippines.—R. G. Lister.

SOCIAL STUDIES. There can hardly have been a topic so readily supported by so many experts yet about which so little is known as Social Studies. It may be that theory is too far ahead of practice, but whatever it is there seems to be a great difference in view between those who advocate social studies in schools and those who actually try to teach it (or them). It is, however, fair to say that both theorists and practitioners are agreed on the ideals that have animated the advocates of social studies. It is in the details of application that divergencies appear.

Social studies is also an attempt to reform both content of the curriculum and teaching method. It would be difficult to refute the fact that the content of history, geography, or science, as taught in the past, was sadly lacking in relevance to modern conditions and to the experience of the ordinary child. The matter was dull, uninteresting and often valueless as knowledge or training. Moreover, school work has in the past been dominated by subjects taught in isolation without any relation one to the other let alone to the problems of modern society. Little attempt was ever made to let children see what was the aim and purpose of their studies, still less the value of the knowledge gained in helping them understand the world of man.

The project method is but one famous example of an attempt to get purpose, interest, activity and relevance into school studies, and it is mentioned here because the idea of social studies developed from successful project experiments.

From another but not dissimilar point of view there are those who disagree with the universal validity of social studies in schools of all types and at all ages. To put it more plainly, though perhaps not so accurately, there are some who say that there is no separate subject or discipline called social studies at all; it is not a hotchpotch of history and geography; it is rather a set of ideas that should determine the selection of matter and the method of teaching of all school subjects. It is, in fact, often impossible to distinguish definitions of the purpose of social studies from definitions of the purpose of education.

Certainly there is good reason to relate history, geography and science, but it does not mean that these subjects should not be taught separately at some stages. On the other hand, there is need to improve the teaching of these subjects rather than to introduce a new subject especially if it, too, is badly taught. In fact it is the contention of this note that the aims and purposes of the advocates of social studies would often be better achieved by teaching each subject of the present curriculum according to the best modern methods than by attempting any unscientific or unhappy marriage of school subjects unless the methods are essentially modern. This assumes, however, that in any school the staff will conscientiously get together and work out a common educational purpose and ideal for the school curriculum as a whole, and consciously select matter and method to achieve that main purpose. But there are other more scientific arguments which tend to weigh against the narrow interpretation of social studies as a hotchpotch of history and geography. Although subjects as now known are not and should not be studied separately in the early junior school or the late secondary school, there are good grounds for stating that a separation but not an isolation of subjects for children from 9 to 15 fits their natural desires and interests better than any muddled synthesis. For this reason, among others, it has often been found that projects work better with children aged 7, 8, 9 and 10, 15, 16 and 17, than with those aged 11, 12, 13, 14.

Finally, if the modern philosophy of geography is properly understood, it is already performing in schools one of the important functions which advocates of social studies claim. Geography is relating the natural and social sciences. Perhaps this explains why there is so little enthusiasm for social studies by geographers. They see no need to muddle up the historical viewpoint with the geographical. They are already effecting an integration of the facts.

If the day-to-day experience of geography teachers and the results of some experimental research can offer any guidance it would all go to stress that it is folly to attempt any comprehensive view of society as a whole before the age of 15 or 16. Children are so much more affected by the way they are taught than by the matter. Greek well taught is very much better training for citizenship than social studies badly taught.

Much trouble has always attended the advocates of social studies when it was necessary to extend their view beyond local studies. With the locality all subjects go well. It is in their extension beyond the known that skill in teaching counts, and a given viewpoint helps. When all is said and done the skill of the teacher is the most important stimulus to learning; method comes second, and matter third.

—N. V. Scarfe.

THE SOCIETY'S LIBRARY. The modest collection of books and periodicals which constitutes the library of the society continues to expand. A list of periodicals received in exchange for the *New Zealand Geographer* was given in Volume IV, Number 1. There have been additions to that list during the last year, and the number of books sent to the editorial office for review—and subsequent inclusion in the library—has steadily risen. In due course a catalogue will be issued, but meanwhile members of the society may assume that all books and periodicals reviewed in this journal are to be found in the library and may be borrowed on application to the librarian.

An interesting and useful addition to the library from a pedagogic point of view is a reference section of school textbooks of geography. Most of the publishers of schoolbooks in Great Britain have generously cooperated in this venture, with the result that some fifty or sixty textbooks are now available for inspection. Most of these cover the syllabus of the School Certificate and University Entrance Examinations, and several are suitable for more advanced studies. A beginning has been made also in the acquisition of textbooks suitable for primary schools. Any teacher who would like help in the choice of books and who desires to examine any particular series is invited to write to the society's librarian at Auckland University College or to the local secretary of the geography teachers' groups in Auckland or Christchurch. The society is indeed grateful to the publishers for their ready interest and help in the creation of this reference library.

Yet books and periodicals are not the only tools of the geographer. Another section of the library is devoted to maps, and although few have yet been received, copies of new publications will no doubt continue to arrive in increasing quantity as the supply position eases. Of the maps already received the most important are a new map of Australia published by W. and A. K. Johnston Ltd., a map of the United Nations published by G. Philip and Son Ltd., and a map illustrating the wartime journeys of Winston Churchill, a product also of the house of G. Philip and Son.

Nevertheless a significant gap remains. If the library of the society is to fulfil its primary function—that of aiding research into the geography of New Zealand by gathering in one place all relevant material, past and present—copies of books, pamphlets and periodicals of an earlier date are needed, and in this respect the society can look only towards the generosity of its members.

WORLD FOOD SUPPLIES: FATS AND OILS. According to the FAO review *Fats and Oils*, total world supplies of visible fats for 1947 were estimated at 10.2 million tons as compared with 12.8 million tons prewar. Production in continental Europe declined by 1.5 million tons between 1938 and 1947, while exports from Africa, Asia and Oceania also declined heavily by 2.1 million tons. These falls have been partially offset by an increase of over one million tons in U.S.A. Although world supplies reached eighty percent of prewar production in 1946 in many countries, especially in Europe, consumption of fats was less than fifty percent of prewar levels. In the United Kingdom the consumption was just under eighty percent of prewar, a figure which corresponds with eighty to eighty-five percent in Australia and New Zealand. In Africa, Asia, India and Latin America, due to lack of shipping (which reduced exports) and wartime industrial prosperity, consumption of fats slightly increased. Europe, where the greatest deficiencies persist, relies almost entirely on animal fats, and the heavy decline in livestock numbers, especially hogs, has resulted in a corresponding decline in the production of fats.

The postwar emphasis on the production of edible fats has made the shortage of soap even more pronounced. Prewar whaling produced half a million tons of whale oil principally from the Antarctic, but during the war this industry virtually ceased. Since 1945, however, rapid increases in output have taken place, 145,000 tons of whale oil being produced in 1946, and 347,000 tons in 1947. Great Britain and Norway figure most prominently in this production. The position of other fish oils in world economy has improved since the war, and in 1946 100,000 tons were produced.

In 1941 U.S.A., faced with the loss of important supplies from the East, began rapidly to expand her indigenous production of oils and fats. This was done mainly by subsidies, and was successful in all sections of production except cotton oilseed (which declined with cotton acreage) and visible butterfat (which declined because of greater production of cheese and processed milk and because of increased sales of liquid milk).

The production of lard, the largest single item in America's fat supply, increased in early 1947 in spite of a slight decrease in hog numbers,but in Canada, despite a rapid increase in the production of lard, tallow and greases up to 1944, there was a decline in overall production, and consequently that country is still heavily dependent upon imported fats.

During the war lack of shipping caused a heavy decline in linseed exports from Argentina and a consequent decline in linseed acreage. Edible oilseed however increased and by 1944 Argentina became the principal world producer of sunflower seed. A further wartime effect was a substantial increase in oilseed-crushing capacity and by 1946 Argentina was ready to crush all its own oilseed including linseed and export the products as oil and cake. From 1943 onwards, shortage of oil fuel caused Argentina to burn large quantities of its supplies to maintain essential transport. Lard and tallow production increased rapidly during the war but in 1946 exports of these were seriously reduced because of strikes in the meat-packing works. However in 1947 exports, which go chiefly to the United Kingdom, were expected to be normal. Exports of fats from Brazil for 1947 were not expected to exceed 20,000 tons. Uruguay, with an anticipated export of 30,000 tons of linseed oil in 1947, can be counted on as an important exporter in the future. Most other South and Central American countries are heavy importers of fats and oils, with increasing demands for these products.

The rehabilitation of the Philippines copra industry was assisted by all possible means and before the end of 1946 shipments were proceeding at a monthly rate even above prewar. In 1947 the production of oil in the Philippines was expected to increase by fifty percent above the prewar figure of 400,000 tons, but postwar allocations have reduced U.S.A.'s and Latin America's shares of Philippines production to less than fifty percent of the total. In India, a decline in the acreage of oilseed crops and an increased demand due to industrialisation, combined with an ever-increasing population, have accentuated the wartime fat shortage. In Ceylon, production of copra was maintained during the war but was affected by drought conditions in 1946. In southeast Asia, countries liberated from the Japanese have been slow to recover oil production because of political instability, shortage of coastal shipping, shortage of food and pressing machinery.

Before the war, China, including Manchuria, was one of the principal suppliers of oilseed, oil and cake (soya beans, groundnuts, rape seed and tung oil). Since hostilities ceased little has moved out of Manchuria, whilst from southern China estimated exports of tung oil were put at fifty percent of the prewar figure. Information in detail is lacking for either prewar or postwar periods in U.S.S.R. but in general the Soviet Union is self-sufficient.

In 1948 the world supply of fats was expected to exceed the 1947 figures by ten percent. Apart from moderate increases in some parts of Europe, most of the further improvement was expected in supplies from Africa, South America and—it was hoped—the Pacific. By 1950 the world's population will have increased by some twelve percent over 1935-1939 and world per capita consumption will still be below prewar. In addition increased per capita consumption in some important countries such as Latin America and the Far East will mean a lower consumption in other countries. Germany is likely to bear the brunt of this shortage, although other European countries will lack the necessary foreign exchange to restore prewar consumption levels.—N. H. WHATMAN.

IN OUR CONTEMPORARIES . . .

1. *In New Zealand Journals . . .*

Agriculture in Northern New Zealand

FARMING IN NEW ZEALAND: INTENSIVE GRASSLAND FARMING: P. W. Smallfield, *N.Z. Journal of Agriculture*, Vol. 76, No. 6, June 1948, pp. 563-579.

FARMING IN NEW ZEALAND: NORTH AUCKLAND PENINSULA: E. B. Glanville, *N.Z. Journal of Agriculture*, Vol. 76, No. 6, June 1948, pp. 549-558, and Vol. 77, No. 1, July 1948, pp. 53-58.

FARMING IN NEW ZEALAND: THE SOUTH AUCKLAND DISTRICT: C. Walker, *N.Z Journal of Agriculture*, Vol. 77, No. 2, August 1948, pp. 131-137, and Vol. 77, No. 3, September 1948, pp. 247-254.

Under a rather misleading title Mr. Smallfield brings to a conclusion his review of farming progress in New Zealand during the 1920-1945 period. In addition to an outline of progress made in the production of dairy produce, fruit, eggs, vegetables and honey, he deals in detail with the changes that have taken place in the marketing of dairy produce, and with the attempts to stabilise farm costs and prices. He concludes with a discussion on the subject of soil fertility: 'Of the forty-three million acres of occupied land in New Zealand, only on about six or seven million acres, comprising the flat and undulating land, is the fertility level being raised, while on much of the twelve million acres of tussock and ten million acres of surface-sown land, fertility is not improving'. After listing the various agencies which would be involved in altering this fertility trend, Mr. Smallfield concludes: 'The science and practice of grass farming evolved on the plains of the dominion must be carried to the hills, even at a great apparent cost, if a permanently-productive farming industry is to be a reality of the future'.

In the first of two articles, Mr. Glanville describes the characteristics and production of each farming district of the 6000 square miles north of Auckland. In the last article of the series (the first was reviewed in our last issue) mention is made of some of the unsuccessful development schemes such as the attempt to establish citrus orchards on the unsuitable ironstone soils near Kerikeri, the planting of thousands of acres of tung trees on areas which now lie derelict, and abortive attempts at large-scale tobacco growing. On the other hand it is made clear that afforestation of much of the poor, scrub-covered, leached land which cannot be farmed economically will eventually pay national dividends. The future of North Auckland will depend on grassland farming. Increase in the production of dairy cows will necessitate the replacement to a large extent of paspalum-dominant pastures by a balance of perennial ryegrass, paspalum and white clover. In addition there must be more hay and silage saved and supplementary crops grown to provide milk-producing feed for the late summer. Large areas of hill country which have fallen to a very low state of production must be brought back or the source of replacements of store sheep and cattle for the farmer on the fattening country will diminish and the sheep industry in general will suffer.

Mr. Walker provides a well-illustrated account of an area of nearly six million acres, not highly endowed with natural soil fertility, which produces two-fifths of the dominion's dairy produce, nearly half its pig meat, a quarter of its beef and a large share of its fat lamb and wool. Coal, gold and timber also add to the wealth drawn from this land. When it is considered that of the area 600,000 acres are in planted forest and one and a half million acres are quite unimproved, the figures become more impressive. The explanation lies in the use made of a beneficent climate which permits all-grass farming and the intelligent exploitation of aids to farming practices. Research has helped considerably, particularly the cobalt-deficient areas. The use of cobalt topdressing in Tauranga county alone enabled the sheep population to rise from 18,000 to 185,000 in twenty-five years. Of particular interest is the description of the pumice country and the methods used in bringing it into full production—cutting and firing of the scrub, full cultivation, good consolidation, sowing of good seed and adequate manuring.

No other area in New Zealand is so fitted for grassland farming. When ample supplies of fertiliser and fencing materials are available and permit heavier topdressing, resowing of run-out areas and subdivision of paddocks, immediate and enormous increases in the production of butterfat, fat lambs and baby beef will be possible.

—L. W. McCaskill.

2. *In Overseas Journals . . .*

Some Observations on Continental Drift

THE GEODETIC EVIDENCE CONCERNING WEGENER'S HYPOTHESIS

H. A. Stamers Smith, *Empire Survey Review*, Vol. 9, Nos. 65 and 66, July and October 1947.

It will be recalled that, in his theory of continental displacement, Wegener postulated that in the Upper Carboniferous the land masses of the earth were aggregated into a vast continent centred about a south pole located in South Africa. Subsequently, in various stages, disrupted fragments of this ancestral continent drifted apart from Africa until finally they reached their present locations. Greenland remained attached to Europe until Pleistocene times, so that its drift from Europe must have been (*fide* Wegener) very rapid.

Depending on early observations of longitude, Wegener claimed that there had been a movement of Northeast Greenland with respect to Europe of nine metres per year between 1823 and 1870 and of thirty-two metres per year in the period from 1870 to 1907.

Stamers Smith discusses the early observations of longitude and shows their unreliability as compared with results obtained with more modern instruments, which show no changes of longitude between 1927 and 1936. There is thus no evidence that Greenland is drifting. If this drift is in progress there must also be changes of latitude which are likely to be so small as to be detectable only by instruments of the highest precision. The westward movement of the Americas, the writer points out, should crumple up the orogenic belt on the west of these continents and lead to measurable gravity anomalies. These await research.

The claim has been made that the Great Pyramid of Cheops in Egypt was aligned originally exactly in the meridian and that its present deviation from this latter is because of slight anti-clockwise rotation of Africa since the pyramid was built. Stamers Smith points out that this claim rests merely on an assumption and that it can be given no more credence than claims that the Straits of Gibraltar and the Straits of Messina have widened in historic times; he shows that the widths of these straits given by Pliny were probably meant as mere approximations.

AN EARLY NEW ZEALAND GEOGRAPHER

THE LIFE AND TIMES OF SIR JULIUS VON HAAST. By H. F. von Haast. Published by the author in Wellington, 1948, pp. 1142.

At the age of eighty-four, H. F. von Haast has been awarded the degree of Litt. D. by the University of New Zealand for his *Life and Times of Sir Julius von Haast.* This degree might well have been an honorary award by the University which he served so long and so zealously as member of the Senate and as Pro-Chancellor, but he earned it in the ordinary way by submitting for examination this massive work which is a monument to the industry of a son devoted to the memory of a remarkable father. It is more than a personal and family history; it is a story of exploration and of the foundation of natural science in early New Zealand. It has been interesting to observe the reaction of friends and acquaintances to this prodigious work. Some have described it as prepcsterous and repelling by its very size; others, notably elderly people whose roots are deep in early Canterbury, have read it from cover to cover with absorbing interest.

Twenty years ago the reviewer delivered a presidential address to the Philosophical Institute of Canterbury (now the Canterbury Branch of the Royal Society of New Zealand) on Sir Julius von Haast, who had been largely responsible for the foundation of the Institute in 1862. The gathering of material for this address presented something of a problem, for all that was then readily available was limited to what could be culled from Haast's published works, notably his *Geology of Canterbury and Westland.* Fortunately, however, it was possible to consult his almost equally remarkable brother-in-law, the late Sir Arthur Dudley Dobson, then approaching his ninetieth year. Dobson had accompanied Haast on his first visit to the Mt. Cook region in 1862 and had himself made notable contributions to the exploration of Westland, including the discovery of Arthurs Pass.

The author's main problem is one of selection. Though he explains that few letters written by Haast were available to him, he had a mass of 'inward' correspondence and material relating to institutions with which Haast was associated. A more or less natural reluctance to leave anything out accounts for the book being too bulky to be easily handled and read. It is mainly for this that the book is open to criticism, for the author has, on the whole, given a fair and often naively frank and honest account of the life and works of his distinguished father.

Sir Julius was a colourful figure in the life of early Canterbury. His association with Hochstetter had directed his abundant energy to natural science, and his appointment as geologist to the infant province of Canterbury opened a virgin field to his enthusiasm for exploring and collecting. He was essentially a collector, and his major achievement was the foundation of the Canterbury Museum. The naively frank description of his deliberately setting about the collection of honours and acquaintance with the contemporary distinguished is one of the most attractive features of the book. The periodic rupture of his relations with Hector and Hutton, and his disputes with McKay and the provincial government of Canterbury are fairly reviewed, and all this helps to make this large book very readable.

To the student of Canterbury history, especially in the field of natural science, this book is indispensable. No major library should be without it. To Canterbury its appearance on the eve of the celebration of the provincial centenary is an event of especial interest.—G. JOBBERNS.

RECORDING ORIGINAL PLACE NAMES

MAORI PLACE NAMES IN BULLER COUNTY. By G. G. M. Mitchell. Wellington: A. H. and A. W. Reed, 1948, pp. 60.

The recording of Maori place names in the South Island has for the reviewer a certain melancholy interest. The always sparse population has not only shrunk absolutely, but relatively also it has been submerged by the crowding of European settlement. What imprints have thirty or forty bare-footed generations left more substantial than the names which in empty places rise up to strike the traveller with surprise?

The author's territory is no exception. By painstaking research in Lands Office records, by enquiries at first-hand, Mr. Mitchell has placed on record 106 names which outnumbered almost ten times the Maoris resident in Buller County when he commenced his labours in 1937. Mr. Mitchell started none too soon, for his one knowledgeable Maori informant was an old man who did not live to see the pamphlet published. Even so the author's old *rangatira* was the grandson of North Island intruders who occupied the Buller coastline in the musket era after displacing the earlier inhabitants, so that the meaning and origin of many place names must always remain unknown. A typical problem is the name of the Buller itself. Spelt in the standard form 'Kawatiri', it was variously rendered to the author as 'green like greenstone'; the 'lifting of Tapu and the thanks offering made to the Atua of the river for a bountiful supply'; 'bitter sounding waters'; and 'repeat again and again the planting ceremonies'. The old man insisted the spelling was 'Kawatere', without being able to explain it further. This, as Williams's Dictionary tells us, means 'parrakeet', but this like all the others is a guess unless the circumstances of its original application are known. Mr. Mitchell's strength lies in the geographic accuracy of his placing of each name, the careful search for the best documented spelling, his caution in interpretation. These are essential qualifications for a recorder of place names, and for recording faithfully in a limited field Mr. Mitchell has made a limited but sure advance.—ROGER DUFF.

MAPPING SOIL EROSION

SOIL EROSION IN NEW ZEALAND. PART I: SOUTHERN HALF NORTH ISLAND. By L. I. Grange and H. S. Gibbs. N.Z. Department of Scientific and Industrial Research, *Bulletin No. 95*. Wellington: Government Printer, 1948, pp. 28.

In 1947 the Soil Bureau commenced to map the incidence of erosion types in the North Island and in a few months had completed the southern half, an area of 15,250,000 acres. The fact that this area includes all the land under the control of the first five Catchment Boards set up in the North Island under the Soil Conservation and Rivers Control Act, is the excuse for publishing these results.

The principal aim in this survey was to separate the different types of soil erosion and map the soils on their erodibility, not according to the severity of the soil loss which has taken place.

The classes of erosion recognised in the survey are shown on two maps. Areas of similar soils are coloured according to the class of erosion common to those soils. It is not necessary that that class should be showing at the present time and as a result the maps show actual *and potential* erosion. Twenty-two photographs illustrate the various erosion types.

On another set of maps a broad view of the problem of soil erosion in relation to land use is provided by grouping the erosion classes into three divisions:

(1) classes that do not lead to significant deterioration of the land;
(2) classes that lead to significant slow deterioration of the land;
and (3) classes that lead to significant rapid deterioration of the land.

Suggestions are made as to the type of further investigations which should be made and experiments carried out to attempt to solve some of the problems connected with soil erosion in the area. Some four categories of soil erosion (out of fifteen) are considered to require urgent action. Results of experiments will take years to finalise, therefore the methods to be followed should be worked out from present day experience. In spite of this urgency, the view is taken that as a whole, 'soil erosion in the southern half of the North Island has by no means reached an alarming size', and no widespread abandonment of farming land is envisaged. On the other hand, 'the survey does strongly indicate the need for action and for investigation in many localities even if our aim is only to maintain the present sheep and cattle population on the hilly and steep land'.—L. W. McCaskill.

Glimpses of Maori Life

THE MAORI IN PICTURE. Edited by Alan Mulgan. Auckland: Whitcombe and Tombs Ltd., 1948, pp. 72.

This book has obviously been designed to be sent overseas as a gift or something of the sort. It consists of a series of forty-seven full-page photographs, expertly printed on good paper, with detailed notes, and a foreword written by Mr. Alan Mulgan with knowledge and taste.

The photographs succeed in showing Maori life in most of its phases today; earlier Maori culture is indicated by a set of reproductions of paintings by Lindauer, Goldie and others. There is a complete absence of patronising in this book—something of an achievement in itself—and it gives a not unfair indication of the position the Maori race occupies in the modern New Zealand community. If the special problems of the modern Maori are barely hinted at, this cannot be regarded as a defect in a book whose purpose is so general.

As an example of the taste displayed, we find that whenever the Maori is shown in native costume, it is made clear that this is not his normal modern dress, but is worn only on special occasions. This is a welcome contrast to the usual misleading publicity photographs and printed matter.—J. C. Reid

New Zealand as it Was

OLD NEW ZEALAND. By A Pakeha Maori (F. E. Maning). Auckland: Whitcombe and Tombs Ltd., 1948, pp. 328.

Old New Zealand, Judge F. E. Maning's reminiscences of life in this country in the early nineteenth century, is rightly regarded as a New Zealand 'classic'. This new edition from Messrs. Whitcombe and Tombs makes the fourteenth impression of the book since its first appearance in 1863.

In *Old New Zealand*, Maning, with colloquial verve, roaring humour and great individuality of expression looks back at the 'good old days' of the 'thirties and paints a vivid, if somewhat distorted, picture of early Maori and pioneering life. He knew the Maori well, as a trader, the husband of a Maori woman, as a *tohunga* and as a Native Land Court Judge, and he combined a natural gift for story telling with high literary skill. *Old New Zealand* is full of scenes as alive as those in a good novel, of ironical passages and of idiosyncratic description and comment. Maning's lively intelligence, his sense of the absurd and his sheer drive make his book as fresh and as forceful today as when it was first written. But the chief reason for its continued popularity is undoubtedly its comic writing. Good comic prose is rare enough in New Zealand, but even if there were more, it would still be difficult to parallel for sheer fun Maning's description of his arrival in this country, or his burlesque account of the custom of *muru* in Chapter VII.

Good as *Old New Zealand* is, it is inferior in literary excellence to *War in the North*, also printed in this volume, which is in the form of a monologue by a chief of the Ngapuhi telling of Hone Heke's War of 1845. Here Maning is setting out seriously to portray the Maori's attitude to the pakeha. His insight into the native mind and his knowledge of Maori oratory enabled him to write a brief work of extraordinary skill, rhythmical, imaginative and powerful, with something of the epic ring about it. The popularity of Maning's other work has tended to overshadow *War in the North*, and so it is gratifying to find both books included in this single volume.—J. C. Reid.

The Far South

THE AUCKLAND ISLANDS. By Fergus B. McLaren. Wellington: A. H. and A. W. Reed, 1948, pp. 110.

The Rev. Fergus Blair McLaren, the author of *The Auckland Islands*, was killed in Greece in 1941, at the age of twenty-seven. This book, written when he was twenty-two, has been published as a memorial volume and edited by Angus Ross, a comrade in arms. It has, however, a good deal more than pious interest, for it presents in a clear, direct and interesting way, and for the first time, the absorbing story of the little-known Auckland Islands.

This bleak, rocky group, 200 miles southeast of the Bluff, was discovered in 1806. For some years, only whalers and sealers visited them. In 1839, a group of Maori refugees from the bloody Maori wars migrated first to the Chathams and later transferred to the Aucklands, where they lived in poverty and destitution. Next came the project of the English Southern Whale Industry, which, on the prompting of Charles Enderby, sought to establish a huge whaling centre at the Aucklands.

As Lieutenant Governor of the islands, Enderby arrived on their inhospitable shores with about a hundred men and women in 1849. The subsequent tale of disappointment, failure and final abandonment of the project in 1852 is very ably told by Mr. McLaren.

After 1860, the Aucklands earned a sinister reputation. They lay on one of the main sea routes, and caused at least ten tragic wrecks, leading to intense suffering and loss of life. The stories of the shipwrecks and survivors are often moving, notably the heroic voyage of Captain Musgrave in 1865 to the mainland in a home-made boat, the loss of the *General Grant* with her 3,000 ounces of gold, and the dreadful privations of the survivors of the wreck of the *Dundonald* in 1907.

Well illustrated and competently written, *The Auckland Islands* gives an admirably full account of the history of a lonely outpost of New Zealand. There is perhaps a little of the smell of the University thesis about the book, but Fergus McLaren was clearly of exceptional ability, and his work has been well worth printing for its own sake.—J. C. Reid.

Some New Zealand Pen-Portraits

OUR OWN COUNTRY. By the Army Education Current Affairs Staff. Hamilton, New Zealand: Paul's Book Arcade, 1948, pp. 173.

Our Own Country is a collection of nineteen short essays dealing with New Zealand. All except one were originally published during the war in *Korero*, the magazine of the Army Education Welfare Service. The authors make no claim as to the accuracy of their statements and descriptions, but are concerned rather with giving their impressions and presenting 'the essential flavour' of New Zealand. Thus, the essays should be considered as literary works and not as scientific contributions to the geography of this country. The book does not suffer unduly as a result of this treatment as long as the reader considers the statements in the above light. Nine of these essays are descriptions of small towns which are so characteristic of urban New Zealand—Kerikeri, Thames, Tauranga, Gisborne, Ruatoki, Lyttelton, Westport, Fairlie, and Arrowtown. These urban studies combine history, folk lore, guide book extracts, poetry, statistics, and personal impressions into a readable travelogue form. The essays on a voyage from Auckland to Thames, and a train journey from Roxburgh to Lawrence are not as typical of New Zealand travel as is the excellent sketch of the North Island Main Trunk Express. One feels disappointed, also, at the lack of a satisfying picture of travel on the 'Inter-island Steamer', although the interest of the frequent traveller may be caught by the lengthy histories of the individual steamer expresses. If the authors have failed here, however, they have more than succeeded in conveying the spirit of the Mackenzie Country to the reader. The sketch of Central Otago is equally successful and delightful in recreating a picture of the Otago landscape. 'Country Newspaper', 'Fishing Boat *Rex*', and 'Before Race Day' are typical scenes from contemporary New Zealand life. The publishers are to be complimented on the excellence of the format, and on the inclusion of the fifty-two drawings and two sketch maps which add materially to the atmosphere of the essays. *Our Own Country* is a welcome addition to the travel literature of New Zealand. It is entertaining and often discerning; it will help to satisfy the demand by non-academic students of geography for readable, descriptive pictures of New Zealand urban and rural landscapes.—L. L. Pownall.

Farm Management in the Americas

THE GRASSLANDS OF LATIN AMERICA. By G. M. Roseveare. Aberystwyth: Imperial Bureau of Pastures and Field Crops, 1948, pp. 291.

This publication is an overall review by the member of the Imperial Bureau of Pastures and Field Crops who has specialised for many years in South American scientific papers and reports.

As would be expected in a project covering a very large number of detailed papers and an equally large range of agricultural and pastoral zones, the average reader will find the going fairly heavy. Especially will this be so for the geographer without a fairly detailed botanical background. Also the stranger to this type of review literature may at first find it rather confusing in that the general story is presented as a somewhat disjointed series of statements. However, as the Director of the Bureau (Dr. Whyte) points out in his foreword, this is the essential basis of all the work done by the Bureau; the reviews by them are always confined to simple statements of the conclusions arrived at by the various research workers.

Given this little bit of extra effort required in reading this book it will be agreed by all that Miss Roseveare has made an excellent job of reducing the large mass of papers and reports to an orderly presentation of the involved problems of pastures and stock raising in Latin America. The first half of the book treats the subject on a regional basis. Although there is a large mass of detailed lists of species involved in this section, most readers will have no difficulty in picking the essential differences from region to region, and in appreciating the enormous problems involved, as well as the equally large grassland potential of the whole area. The second half of the book treats the subject from a general angle and deals in detail with such aspects as Soil Conservation, Improvement by Temporary Ley, and Pasture Management. It is in this part that New Zealand readers will find much of immediate interest. The theme of burning versus nonburning is discussed in detail and is of direct interest to those concerned with maintaining a pasture cover from 'natural' associations. The great need for more legumes in the swards, and the supply of the essential phosphates and lime to encourage these, is emphasised throughout, both for increased herbage yield as well as for animal health. Those with a knowledge of the methods followed in developing the 'problem' areas of New Zealand will see the parallel line of thought and action required in these American countries. Of great interest, too, is the evidence of the apparent change in the economy of some of the states and countries. Whereas up to the present there has been a fairly clearcut field of exploitation and an export of grazing animals, South American workers are now realising that the well of soil fertility is drying up; this fact, coupled with a rising internal demand for meat, is leading to a change in the internal location of 'store' and 'fat stock' country. It is of very considerable interest in this respect to read as an introduction the latest publication from the T.V.A. authority wherein the soil phosphate story is discussed in some detail.

Such comparative reading undoubtedly makes this detailed review much more stimulating to further study by all those interested in agricultural geography. A full reference list, good maps and details of research work in progress make this review a valuable piece of work.—P. D. Sears.

PRINTED BY WHITCOMBE & TOMBS LIMITED—49938

THE NEW ZEALAND GEOGRAPHICAL SOCIETY

OFFICERS

Chairman: Mr. A. C. Pitcaithly, M.A.
Secretary-Treasurer: Mr. B. J. Garnier, M.A.
Trustee: Mr. A. H. Payne, M.A.

Councillors:
Miss J. K. Finney, M.A.
Mr. A. L. Ferguson, B.A.
Hon. Editor: Dr. Kenneth B. Cumberland, M.A.
Hon. Assistants to the Editor:
Mr. J. L. Hewland, M.A.
Mr. J. W. Fox, B.A.
Miss A. M. Iverach

The New Zealand Geographical Society was founded officially in Wellington towards the end of 1944. Its real foundation, however, took place in Christchurch in 1939 when a group of enthusiasts formed what is now the Canterbury Branch of the Society. Their lead was followed in February 1944 in Wellington, and further branches came into being in Auckland and Dunedin early in 1945.

The aims of the Society as stated in the constitution are 'to promote and stimulate the study of geography'. These are the aims of more than one Society in the world and the New Zealand Geographical Society is particularly concerned with geography in New Zealand. It is therefore the Society's policy to stimulate geographic studies of New Zealand and matters closely related to the Dominion.

The Society undertakes the publication of a journal which at present appears twice a year. Branches of the Society organise lectures, study groups, and excursions, and encourage their members to prepare matter for publication in the Society's journal, the *New Zealand Geographer*. Contributions from overseas writers and those who are not members of the Society are also encouraged.

Membership of the Society is open to all persons interested in the aims of the Society. Full details of membership will be sent on request by the Secretary, New Zealand Geographical Society, Department of Geography, University of Otago, Dunedin, N.1.

MEMBERSHIP DUES

Individuals in New Zealand *one pound* per annum. (A special rate of *ten shillings* is available to full-time student members of a recognised educational institution.)

New Zealand Geographer: SUBSCRIPTION RATES

Libraries, schools, etc. in New Zealand, *one pound* per annum.
Individuals, libraries, schools, etc., overseas, *one pound* or *four dollars* per annum in local currency.

GEORGE **PHILIP** & SON, LTD.
LONDON ENGLAND

Supplies of our Atlases, Maps, Globes and Books are inevitably restricted at the present time. We are, however, doing our utmost to keep faith with our many customers in New Zealand, and we look forward to the time when conditions will permit us to meet all requirements in full and without delay.

INQUIRIES TO
GORDON KNIGHT
32 Endeans Buildings, AUCKLAND

LANDSCAPE
AS DEVELOPED BY
THE PROCESSES OF NORMAL EROSION
By C. A. COTTON

The first volume in Professor Cotton's notable trilogy dealing with the subject of landscape, this new edition has been considerably enlarged and in part re-written. Many new photographic illustrations add greatly to its value and interest.
The general reader who desires to know something of the forces that have shaped the earth's surface will find in "Landscape" a continuous story set before him; the student of geology and geography will find it an indispensable book both for study and reference.

509 pages Illustrated Indexed

Second edition published by arrangement with the Cambridge University Press

Obtainable in U.S.A from
JOHN WILEY & SONS, INC.

Price **47/6**

WHITCOMBE & TOMBS LTD.

NEW ZEALAND
GEOGRAPHICAL SOCIETY

REPRINT SERIES

This series of reprints from the *New Zealand Geographer* was inaugurated early in 1946, and numbers will be added from time to time.

No. 2. LITERATURE AND LANDSCAPE IN NEW ZEALAND. *By Alan Mulgan.* 2s. 0d.
(*Members: individual copies* 1s. 8d., *twelve or more copies* 1s. 2d. *each*).

No. 3. MANUFACTURING IN NEW ZEALAND: ITS OUTSTANDING CHARACTERISTICS. *By J. L. Hewland.* 1s. 3d.
(*Members: individual copies* 1s. 0d., *twelve or more copies* 9d. *each*)

No. 4. LAND UTILISATION IN METROPOLITAN CHRISTCHURCH. *By F. Parks.* 2s. 6d.
(*Members: individual copies* 2s. 3d., *twelve or more copies* 2s. *each.*)

No. 5. THE IMPORTANCE OF THE LAND: THE FUTURE OF NEW ZEALAND AGRICULTURE. *By Kenneth B. Cumberland.* 1s. 3d.
(*Members: individual copies* 1s. 0d., *twelve or more copies* 9d. *each.*)

OBTAINABLE from The Secretary, N.Z. Geographical Society, Department of Geography, University of Otago, Dunedin, N.1, or from WHITCOMBE & TOMBS LIMITED and other booksellers.